CIVIL ENGINEERING

THE MAGAZINE OF ENGINEERED CONSTRUCTION

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• *In This Issue*

Program of 1949 ASCE Summer Convention in Mexico City . . . 17
Trend in Hydroelectric Practice Favors Simplified Station Design and Automatic Operating Features. . . . . *W. S. Merrill and M. G. Salzman* 22
Colorado–Big Thompson Project Irrigates 600,000 Acres, Generates 600 Million Kwhr . . . . *L. N. McClellan* 27
Atomic Energy Town of Richland, Wash., Grows from 250 to 25,000 Population . . . . *David J. Brumley* 31
Navy Spends $40 Million on Research Facilities *Daniel P. Higgins* 36
Sizes and Weights of Motor Vehicles Require Economic Study . . *Herbert S. Fairbank* 40
Mile-Long Cofferdam Withstands 75-Ft Head in Chain of Rocks Project . . . . *E. E. White* 44
Header Assembly Permits Grouting Against High Hydrostatic Pressures . . . . *George T. Evans* 48

• *Society News*

Arthur S. Tuttle, Past-President and Honorary Member, Dies 50
Pacific Northwest Sections Study Local Problems in First Regional Conference 50
Malcolm Pirnie Honored at EIC Annual Meeting 51
Society Adopts Group Plan of Disability Insurance 51
Tips to Members Attending ASCE Convention in Mexico City 52
Eleven Regional Spring Conferences Are Sponsored by ASCE Student Chapters 53
Professional Guide for Engineers Issued by ECPD 58
American Engineers to Present Papers at Rio de Janeiro 60
EJC Survey Shows Down Trend in Employment of 1949 Engineering Graduates 60

• *News Briefs*

Construction Activity for First Quarter of 1949 Exceeds 1948 Total for Period 70
Port Authority Offers New Plan to Improve New York Waterfront 70
R. E. Dougherty to Serve on White House Renovation 72
Highway Departments to Test Rubber Pavements 74
Vice-President Proctor Made Moles President 76
Concrete-Placing Method Tested by Army Engineers 76

• *Departments*

Engineers' Notebook 48
The Readers Write 49
News Briefs 70
N. G. Neare's Column 78
News of Engineers 80
Deceased 83
Positions Announced 86
Western Projects Announced by U.S.B.R. 86
Meetings and Conferences 87
New Publications 88
Men and Jobs Available 90
Recent Books 94
Equipment, Materials and Methods 96
Literature Available 102
Index to Advertisers 108

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American Society of Civil Engineers

1949 Summer Convention—Mexico City

HOTEL DEL PRADO *July 13–15, 1949*

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Associación de Ingenieros y Arquitectos de Mexico
Colegio Ingenieros Civiles de Mexico
Centro Nacional de Ingenieros
Associación Mexicana de Contratistas

Registration and ticket sales at headquarters only, Hotel Del Prado, Mexico City, D.F., Mexico. Opens 9:00 a.m., Tuesday, July 12

Official Inauguration and Welcome to Mexico City, Wednesday, July 13

11:00 A.M., PALACE OF FINE ARTS

Reception to His Excellency the President of Mexico, Lic. Miguel Aleman Valdes and members of Cabinet

March of Honor

Mexican National Anthem by the Presidential Band

Welcome to Mexico

Extended by the President of the Colegio Ingenieros Civiles de Mexico, ING. LUIS FLORES ARIAS.

Response

President of the American Society of Civil Engineers, DEAN FRANKLIN THOMAS.

Declaration of Inauguration of the Summer Convention of ASCE

President of Mexico, LIC. MIGUEL ALEMAN VALDES.

Note: Immediately preceding the Official Inauguration at the Palace of Fine Arts, the ASCE Business Meeting during the Annual Convention will be convened.

General Session—Water Resources of Mexico

WEDNESDAY AFTERNOON—2:00 P.M. (14:00) SALON DE FIESTAS, HOTEL DEL PRADO

Presiding: Royce J. Tipton, M. ASCE, Consulting Engineer, Denver, Colo.

(1) **Activities of the International Boundary and Water Commission, United States and Mexico, in the Development of Joint Water Resources**

Presentation by

L. M. LAWSON, Hon. M. ASCE, Commissioner for the United States.

Response by

ING. DAVID HERRERA JORDAN, Commissioner for Mexico.

(2) **The Utilization of the Hydraulic Resources of Mexico**

ING. ADOLFO ORIVE ALBA, Secretary, Ministry of Hydraulic Resources.

(3) **The Human Aspects of Mexican Irrigation**

ING. ANTONIO RODRIGUEZ L., Director of Water Development.

(4) **Passing Flood Waters Over Dams During Construction**

ING. ANDREW WEISS, Hon. M. ASCE, Chief of Consulting Department, Ministry of Hydraulic Resources.

Social Activities, Wednesday, July 13

12:30 p.m. **Joint Membership Banquet, ASCE and Cooperating Societies—Hotel Del Prado**

8:00 p.m. (20:00). **Dinner and Dance—Hotel Del Prado**

FAMOUS MINING TOWN of Taxco, Mexico, has preserved its original Spanish character. On recently built motor highway, Taxco is accessible to visitors and is popular tourist resort. Members taking two-day post-Convention trip will spend night here.

Sessions of Technical Divisions, Thursday Morning, July 14

Construction–Soil Mechanics and Foundations Divisions, Joint Session

10:00 A.M.

Presiding: Carlton S. Proctor, Vice-President, ASCE; First Chairman, Soil Mechanics and Foundations Division.

(1) **Present Building Foundation Problems in Mexico City**

ING. LEONARDO ZEEVAERT, Assoc. M. ASCE, Visiting Research Associate, University of Illinois, Consulting Engineer, Mexico, D.F., Mexico.

(2) **Field Construction to Overcome Mexico City's Foundation Difficulties**

ING. PEDRO ALBIN, JR., Jun. ASCE, Construction Engineer, La Latino Americana, Mexico, D.F., Mexico.

(3) **Soil Research on Fine Sand for Care of Alvaro Obregon Dam**

ING. RAUL J. MARSAL, Secretary of Hydraulic Resources of Mexico, Heriberto Frias No. 623, Col. Narvarte, Mexico, D.F., Mexico.

(4) **Strain Disturbance Produced by Rigid Pile in an Elastic Mass**

DR. NABOR CARRILLO, Professor of Civil Engineering, National University of Mexico, Mexico City.

Highway Division

10:00 A.M.

Presiding: Charles M. Upham, M. ASCE, Chairman, Committee on Highway Construction, Highway Division

(1) **Economic Development Resulting from Road Building**

ING. ROMULO O'FARRILL, President, Asociación Mexicana de Caminos, Mexico City, D.F., Mexico.

(2) **Feeder Roads on the Feeder Road System**

ING. RENE ETCHERREN, Chief, Bureau of Rural Roads, Asociación Mexicana de Caminos, Mexico City, D.F., Mexico.

(3) **Federal Road Program**

ING. ARMANDO SALINAS, Director General de Caminos, Secretaria de Comunicaciones, Mexico, D.F., Mexico

(4) **Aerial Surveying for Highway Locations and Engineering in Tropical Countries**

WILLIAM T. PRYOR, Assoc. M. ASCE, Public Roads Administration, Washington, D.C.

Irrigation Division

10:00 A.M.

Presiding: C. M. Ainsworth, M. ASCE, Chairman, Irrigation Division, Principal Engineer, U.S. Section, I.B.& W.C. and Ing. J. C. Bustamante, Jun. ASCE, Principal Engineer, Mexican Section, I.B.& W.C.

(1) **Design of Irrigation System**

W. H. NALDER, M. ASCE, Chief Designing Engineer, Bureau of Reclamation, Denver, Colo.

(2) **The Hydrology of Mexico**

ING. ANDRES GARCIA QUINTERO, Director of the Department of Hydrology, Ministry of Hydraulic Resources

Sessions of Technical Divisions, Thursday Afternoon, July 14

Irrigation Division

2:00 P.M., (14:00)

Presiding: C. M. Ainsworth, M. ASCE, Chairman, Irrigation Division, Principal Engineer, U.S. Section, I.B. & W.C., and Ing. J. C. Bustamante, Jun. ASCE, Principal Engineer, Mexican Section, I.B. & W.C.

(1) **Operation and Maintenance of Irrigation Systems**

RAYMOND A. HILL, M. ASCE, Consulting Engineer, Leeds, Hill and Jewett, Los Angeles, Calif.

(2) **Design and Construction of Dams in Mexico**

ING. JOSE VICENTE OROZCO, Assoc. M. ASCE, Chief Engineer of Irrigation, Ministry of Hydraulic Resources.

Social Activities, Thursday, July 14

10:00 a.m. **Ladies' Shopping Tour**

7:30 p.m. (19:30). **Reception and Buffet Supper**

Speaker: HONORABLE WALTER THURSTON, United States Ambassador to Mexico.

Motion pictures of the outstanding projects undertaken by the Ministry of Hydraulic Resources.

This event is given by ING. ADOLFO ORIVE ALBA, Secretary of Recursos Hidraulicos.

Waterways and Power Divisions, Joint Session

2:00 P.M. (14:00)

Presiding: Milton G. Salzman, M. ASCE, Chairman, Executive Committee, Power Division.

(1) **Objectives of ASCE Power Division**

MILTON G. SALZMAN.

(2) **Water Power Development in Mexico**

ING. ALIJANDRO PAEZ URQUIDI, General Director, Comision Federal de Electricidad, Mexico, D.F., Mexico.

Discussion

(3) **High-Head Francis Turbines at Ixtapantongo Development**

R. B. WILLI, Supervising Engineer, I. P. Morris Department, The Baldwin Locomotive Works, Philadelphia, Pa.

W. H. MACNAMEE, The Baldwin Locomotive Works, Philadelphia, Pa.

Discussion

(4) **Rectification of the Rio Papaloapan**

ING. REYNALDO SCHEGA C., Project Engineer, Rio Papaloapan Development, Department of Hydraulic Resources.

(5) **Control Problems on the Colorado River**

CARL VETTER, M. ASCE, Senior Engineer, U.S. Bureau of Reclamation, Boulder City, Nevada.

Engineering Education

SPONSORED BY THE ASCE COMMITTEE ON ENGINEERING EDUCATION

2:30 p.m. (14:30)

Presiding: William J. Armento, Chairman, Committee on Engineering Education

Demand–Supply Factors of Engineering Education

L. M. K. BOELTER, Dean of Engineering, University of California, Los Angeles, Chairman, Manpower Committee, ASEE

Professional Needs of the Civil Engineer

CHARLES B. MOLINEAUX, M. ASCE, Chief Engineer, Arthur A. Johnson Corp., Long Island City, New York.

Excursions Friday, July 15

A number of tours to points of engineering interest in and near Mexico City have been arranged. Selection of tours must be made at the registration desk on Wednesday, July 13, so that appropriate plans can be made to accommodate visitors at the projects.

Miguel Aleman Hydroelectric System

When completed, the Miguel Aleman system will develop 233,700 kw for use in and near Mexico City. Regulates Valle de Bravo and Tilostac Project, under direction of Comisión Federal de Electricidad, which will conduct the tour. The Secretary of the Comisión, Ing. Eugenio Riquelme, will offer the transportation and the luncheon for this tour. For those who wish to stay overnight on the project, rooms and meals will be furnished. Estimated cost of trip is $10.00.

Leave Hotel Del Prado 8:00 a.m.
Return Hotel Del Prado 7:00 p.m. (19:00)

Valsequillo Irrigation System

Project located in the State of Puebla will irrigate 292,000 acres and generate 16,500 kw power at two generating stations under construction. Earth- and rockfill dam, canal, siphons, and tunnels are under construction.

Project is reached by two-hour drive on Mexico Puebla highway and one-hour drive on project access road. The Secretary of Recursos Hidraulicos, Ing. Adolfo Orive Alba, offers transportation and a luncheon at the dam site. Estimated cost of trip is $6.50.

Leave Hotel Del Prado 8:00 a.m.
Return Hotel Del Prado 8:00 p.m. (20:00)

Women's Tours on Friday, July 15

9:00 a.m. Leave Hotel Del Prado for tour of Mexico City

5:00 p.m. (17:00) Lecture on colonial architecture at Franklin Library

Tours on Saturday, July 16

NOTE: **Selection of tours must be made at registration desk on Wednesday, July 13.**

12:00 **Roping Contest and amateur bullfight at Rancho La Tapatia.**

Technical Excursions

Rio Lerma Tunnel

Located in Toluca and Mexico valleys, 10-ft-dia tunnel, 8 miles long, will deliver potable water to Mexico City. The tunnel is under construction by Cia. Urbanizaciónes, S.A., for the Departmento del Distrito Federal. Trip will visit Desierto de los Leones Convent en route. Estimated cost is $6.00.

Leave Hotel Del Prado 7:00 a.m.
Return Hotel Del Prado 12:00 noon.

Xatepingo Pumping Station—Tacubaya Diesel Plant—Secretaria Recursos Hidraulicos Laboratory

The pumping station is located in southern Mexico City, near Tlalpan, a part of Mexico City's water supply system. Project was designed to house five 23,800-gpm and 11,900-gpm centrifugal pumps, and was built under direction of the Departmento del Distrito Federal.

The diesel plant is located at Tacubaya in the Federal District. It is a generating station supplying power for Mexico City. It has five 6,000-kw units with 8,500-hp diesel engines, and is under construction by Civ. Mexicana de Luz y Fuerza Motirz for the Comisión Federal de Electricidad.

The experimental laboratories are located in Tecamachalco Municipal, at the outskirts of Mexico City and include hydraulics laboratories, soil mechanics laboratories, materials testing laboratories, and elasticity laboratories.

Approximate cost of the combined trip is $2.50.

Leave Hotel Del Prado 7:30 a.m.
Return Hotel Del Prado 12:00 noon.

Tours within or near Mexico City

1. **Guadalupe Shrine,** the most famous in Mexico; 20-minute drive.
2. **Teotihuacan Pyramids,** built centuries before the Conquest by Toltec Indians and dedicated to the sun and the moon; two-hour drive from downtown.
3. **Xochimilco Floating Gardens,** a delightful trip in native flower-adorned canoes, through picturesque canals, flower lined; 30-minute drive from the city.
4. **Mexico City by Day,** including the **Cathedral,** built on the remains of the Aztec main Teocalli (temple); the **National Palace** where Diego Rivera painted the famous murals depicting the history of Mexico; the **Archaeological Museum,** containing a collection of pre-hispanic relics and the famous Calendar of the Sun, and sacrificial stones; **Chapultepec Park and Castle,** ancient playground of the Aztec emperors, including beautiful gardens surrounding the majestic castle of the Emperor of Mexico, Maximilian Hapsburg, of Austria.
5. **Mexico City by Night,** including visits to the plush Ciro's Club, adorned by Diego Rivera's murals; Claridge Night Club and El Patio Club, most picturesque, with an excellent floor show.

Post-Convention Excursions

For the days following the ASCE Summer Convention, a splendid six-day sightseeing tour of Mexico has been arranged. This will be by motor car and will include Cuernavaca, Taxco, Acapulco, Guadalupe Shrine and the Pyramids of Teotihuacan. This tour has been arranged especially for ASCE. All inquiries should be addressed to:

Mr. Ralph L. Preble, Convention Manager
United States Travel Agency
807 15th Street, N.W.
Washington 5, D.C.

A variety of other post-convention trips are being arranged in Mexico.

1. Cuernavaca and Taxco—Two-Day Trip

Round trip, 200 miles. Lunch in Cuernavaca and visits to the summer palace of Hernan Cortes, the Borda Gardens, the 16th Century Cathedral, shopping tours through markets abundant in native wares, shows, and basketry. Taxco, where the night will be spent in beautiful hotels, is a colonial jewel, where Humboldt and Borda built their beautiful homes. Here the native craftsman is the silversmith, and exquisite silver and copper jewelry and ornaments abound. For those who enjoy golf, there is the beautiful Cuernavaca Golf Club.

2. Puebla, Cholula, Tehuacan, Fortin de las Flores—Three-Day Trip

Round trip, 426 miles. Cholula is the city of 365 churches dominated by a massive pyramid through which one passes on the way to Puebla where one admires the cathedral, the famous hidden convent of Santa Monica, tile and pottery factories and onyx shops. Tehuacan is noted for its health-restoring springs. The trip continues into Orizaba Valley, where the visitor will see innumerable tropical flowers and orchards from which Fortin de las Flores derives its name. The night is spent at the beautiful Ruiz Galindo Hotel, where every day thousands of fresh gardenias are thrown to float on the swimming pool.

3. Paricutin Volcano, San Jose Purua, Patzcuaro, Uruapan and Morelia—Three-Day Trip

Round trip, 718 miles. San Jose Purua, first on this trip, is a sulfur bathing spa noted also for its excellent cuisine. Colonial Morelia is the capital of the state of Michoacan, noted for its fine Cathedral and University of San Nicolas de Hidalgo. Lake Patzcuaro, where live the colorful Tarascan fishermen, on the Island of Janitzio, is reached easily by motor launch. In Uruapan, lacquered work on furniture and gourds is a native art. Lastly, the newly formed volcano of Paricutin, born four years ago in a fertile valley, may be seen to best advantage in the evening, illuminated by the glare of its explosions. Old clothes should be worn on this trip.

4. Cuernavaca, Taxco, Acapulco—Five-Day Trip

Round trip, 600 miles. As an extension of the trip outlined in Paragraph 1, Acapulco can be reached by plane from Mexico City, or by motoring past Taxco. Acapulco is a beautiful tropical resort, fast gaining recognition as one of the most unusual in the world, with warm weather the year round, picturesque beaches and tropical lagoons, deep-sea fishing, colorful night life with a variety of clubs and excellent hotels.

Recreational Facilities Available

1. **Facilities of the Athletic Reforma Club,** an exclusive place, are offered to the members of the Society and their families, who may care to play tennis, football, volleyball, cricket, swimming, or simply to enjoy sun bathing while in Mexico City.

2. **Golf enthusiasts** will enjoy the beautiful greens of the Chapultepec Golf Club, overlooking the Valley of Mexico, and the Mexico City Country Club of Churubusco.

Hotel Reservations and General Travel Information

Headquarters of the Convention will be the Hotel Del Prado. A block of rooms has been set aside in this hotel for use of ASCE Convention visitors. Reservations must be requested before June 20, to assure accommodations at the headquarters hotel. In addition, the Mexico City Committee on Arrangements has made arrangements for rooms at other principal hotels of the city. In all cases early reservations are esssential if rooms are to be assured. Following is a list of hotels and rates, in Mexican currency (Pesos):

HOTELS	SINGLE	DOUBLE
Del Prado	From 25.00	35.00
Regis	From 15.00	25.00
Prince	From 18.00	30.00
Reforma	From 25.00	30.00
Geneve	From 12.00	20.00

For convenience in reserving hotel accommodations, a special form is furnished on page 91. This should be air-mailed at once to the Hotel Accommodations Committee at the address shown.

Tourist Card for Entering Mexico

To enter Mexico, United States citizens should procure a tourist card costing $2.10, obtainable by personal or written application to the nearest Mexican Consulate. A special arrangement has been made with the Mexican Government to simplify this procedure. The special forms are available on request at ASCE Headquarters, 33 West 39th Street, New York 18, N.Y. Application for a tourist card must be accompanied by definite proof of U.S. citizenship, such as a birth certificate. In addition to tourist cards, members from Canada will use their Canadian passports. Citizens of other countries should consult the nearest Mexican Consulate as to necessary papers.

Those who are not American citizens by birth should discuss their special cases with the nearest Mexican Consulate. This applies mainly to those born in European countries. A foreign student studying in the United States must carry a letter from his university, stating that he is a student in good standing, is going to Mexico only for the purpose of attending the convention, and will continue his studies on return to the United States.

Vaccination Certificate Required

A valid certificate indicating smallpox vaccination within the past three years is essential for re-entry into the United States. Those without such certificates will be placed under surveillance and required to report to the Public Health Officer in their area. Particular care should be taken to eat no strange foods, and it is desirable to drink only boiled or bottled water, eat only such foods and vegetables as are cooked or pealed, and use boiled, canned, or powdered milk.

Registration and Information

An information and registration desk will be maintained at the headquarters, Hotel Del Prado, opening Tuesday morning, July 12, and remaining open throughout the days of the meeting. Mail will be delivered to members at the address given at registration or held at the registration desk. A special message service will be operated. There will be no advance registration or ticket sales. All tickets will be sold at the registration desk.

An information clerk will be available each day at the registration desk to assist all visitors.

Ladies' Headquarters

For the duration of the Convention, a special suite will be provided for gatherings of ladies attending the convention. This will be a convenient place for meeting friends, planning activities, playing bridge, etc.

Special Trips

The Secretary of Recursos Hidraulicos, ENG. ADOLFO ORIVE ALBA sponsors, for those coming to Mexico by train or automobile, special trips to projects in northern Mexico.

Those coming into Mexico by the Southern Pacific Line, through Nogales, might visit the Sanalona Dam, already finished, and the Oviachic Dam, under construction.

For those coming through El Paso, Tex., there is a trip to Las Virgenes Dam, near Chihuahua, Chih.

Those coming through Laredo, Tex., might visit Don Martin Dam.

Special cars will be waiting in case there are enough persons who want to take such trips.

Committees for Summer Convention

Special Planning Committee

Charles M. Upham, *Chairman*
George D. Camp, *Mexico City Contact Member*
Lawrence M. Lawson
Adelbert Diefendorf
Earnest E. Howard
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Mexico City Committee on Arrangements

Ing. Agustin M. Valdes, *Chairman*

Ladies Hospitality and Entertainment

Sra. Orive Alba, *Honorary President*
Sra. Eugenio Riquelme, *Honorary Vice-President*
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Sra. Armando Santacruz, Jr.
Sra. Jesus Perez y Perez
Sra. Jose Rivera R.
Sra. Pedro Alvin, Jr.

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Ing. Armando Santacruz, Jr., *Chairman*

Excursions and Recreation

Ing. Jesus Perez y Perez, *Chairman*

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Ing. Aurelio Benassini, *Chairman*

Hospitality

Ing. Alfonso Castello, *Chairman*
Ing. Pedro Alvin, Jr.

Information

Ing. Jose Rivera R., *Chairman*

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Secretary: Ing. Federico Huacuja

Colegio Ingenieros Civiles de Mexico

President: Ing. Luis Flores Arias
Secretary: Ing. Alberto Ortiz Irigoyen

Centro Nacional de Ingenieros

President: Ing. Teodoro C. Aguirre
Secretary: Ing. Jose Vasquez Schiaffino

Associaciôn Mexicana de Contratistas

President: Ing. Leopoldo Farias
Secretary: Ing. Santos Amaro

How to Travel to Mexico

BY AIR:

From any point in the United States with regular air service, the trip to Mexico City can be made in a single day or less. Typical schedules and fares are given below. Your nearest travel ticket office will give you fares from your airport. There are two special-fare inducements, a special excursion fare offered by many lines and a family plan offered by certain lines. Inquire about these special fares.

Lv. Seattle—United Airlines.....12:30 p.m.
Arr. Mexico City—American Airlines.................... 7:50 a.m.
Round-trip excursion fare, $311.36.

Lv. San Francisco—American Airlines.................... 6:00 p.m.
Arr. Mexico City—American Airlines.................... 7:50 a.m.
Round-trip excursion fare, $218.50.

Lv. Los Angeles—American Airlines.................... 8:10 p.m.
Arr. Mexico City—American Airlines.................... 7:50 a.m.
Round-trip excursion fare, $172.50.

Lv. Chicago—American Airlines 2:00 p.m.
Arr. Mexico City—American Airlines....................11:30 p.m.
Round-trip excursion fare, $212.41.

Lv. New York—American Airlines....................12:30 p.m.
Arr. Mexico City—American Airlines....................11:30 p.m.
Round-trip excursion fare, $266.57.

Lv. New York—Eastern Airlines. 8:45 a.m.
Arr. Mexico City—Pan American.................... 8:00 p.m.
Round-trip excursion fare, $266.57. (Also offers return via Havana, Cuba, and Miami, Fla.)

Lv. Washington, D.C.—Eastern Airlines.................... 9:45 a.m.
Arr. Mexico City—Pan American.................... 8:00 p.m.
Round-trip excursion fare, $242.84.

Lv. Washington, D.C.—American Airlines..............11:15 p.m.
Arr. Mexico City—American Airlines.................... 8:10 a.m.
Round-trip excursion fare, $242.84.

Lv. Dallas—American Airlines.. 5:10 p.m.
Arr. Mexico City—American Airlines....................11:30 p.m.
Round-trip excursion fare, $122.13.

BY RAIL:

Your rail travel arrangements to attend the Mexico City Convention of ASCE will be expedited by a call to your favorite travel agent or railroad ticket office. Several agents have offered their services in connection with this convention and are listed below. Typical of the special rail travel arrangements available are the following:

From St. Louis

Through the efforts of Vice-President R. B. Brooks, a member of the Special Planning Committee, the Missouri Pacific has agreed to furnish special cars for ASCE. Two dates are available as follows:

Lv. St. Louis, Thursday, July 7...5:30 p.m.
Arr. Mexico City, Saturday, July 9........................8:30 p.m.
and
Lv. St. Louis, Sunday, July 10....5:30 p.m.
Arr. Mexico City, Tuesday, July 12........................8:30 p.m.

Round trip fare $123.86, Bedroom (2 persons) $26.11. Address your inquiries for this train to: Mr. R. J. McDermott, General Passenger Traffic Manager, Missouri Pacific Lines, 1600 Missouri Pacific Bldg., St. Louis 3, Mo.

From West Coast Cities

Coordination of transportation to Mexico from West Coast cities has been undertaken by Past-President Ray L. Derby of the Los Angeles Section. The Southern Pacific Lines have offered special car service from Los Angeles to Mexico City with connections with other cities up the coast en route. One schedule is suggested as follows:

Lv. San Francisco, Friday, July 8. 8:00 a.m.
Lv. Los Angeles, Friday, July 8..8:10 p.m.
Arr. Mexico City, Tuesday, July 12........................8:25 a.m.

Round trip fare $127.34, Lower $20.70. Address your inquiries for this trip to your nearest Southern Pacific passenger agent.

From New York City

Through-car rail transportation is available from New York City to the convention city. The New York Central System has reserved special cars for two days as follows:

Lv. New York, Wednesday, July 6........................11:00 p.m.
Arr. Mexico City, Saturday, July 9........................ 8:00 p.m.
and
Lv. New York, Thursday, July 7. 11:00 p.m.
Arr. Mexico City, Sunday, July 10........................ 8:00 p.m.

Round-trip fare is $223.93. One-way drawing room occupied by two or three persons is $137.61; compartment, two persons is $101.47. Address all inquiries regarding these special cars to Mr. John P. Sweeney, Passenger Representative, New York Central System, 466 Lexington Avenue, New York 17, N.Y.

Special Travel Agents

The Society has not appointed any travel agency as its "official" travel agency for this Convention. Some of the agencies interested in providing travel service for our members are:

United States Travel Agency, Inc.
Attention Mr. Ralph L. Preble
807 Fifteenth St., N.W.
Washington 5, D.C.

American Express Co.
65 Broadway
New York, N.Y.
(See also local offices)

Elfast Service Corporation
55 West 42nd Street
New York 18, N.Y.

Latin American Travel Agency
510 West Sixth Street
Los Angeles, Calif.

Note: See also "Tips to Members Attending ASCE Convention in Mexico City," by Robert B. Brooks, Vice President, ASCE, page 52 of this issue.

BY HIGHWAY:

If you are planning to enjoy a long, leisurely vacation trip, the motor trip to Mexico is unsurpassed in breath-taking beauty. Sponsored by the new San Antonio Branch of the Texas Section, a motorcade has been planned from San Antonio to Mexico City.

Participants in this motorcade will assemble in San Antonio on or before Saturday, July 9, and drive with special escort for three days. Full cooperation of the Mexican Government will expedite border clearance and all travel details.

A dinner meeting of all travelers will be held Saturday evening at the Gunter Hotel in San Antonio where last details will be explained. The travel schedule follows:

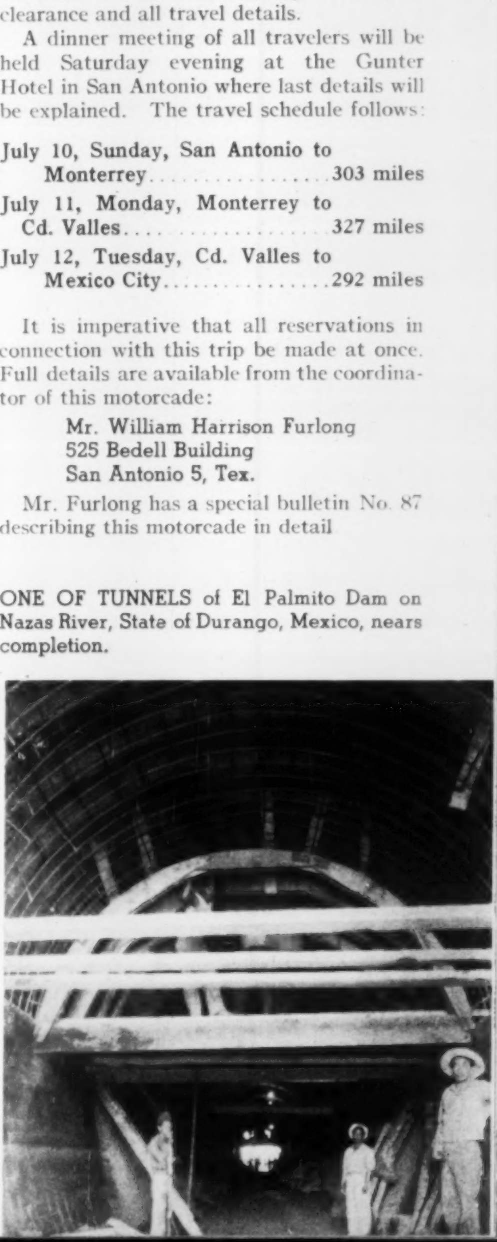
July 10, Sunday, San Antonio to Monterrey................303 miles
July 11, Monday, Monterrey to Cd. Valles....................327 miles
July 12, Tuesday, Cd. Valles to Mexico City................292 miles

It is imperative that all reservations in connection with this trip be made at once. Full details are available from the coordinator of this motorcade:

Mr. William Harrison Furlong
525 Bedell Building
San Antonio 5, Tex.

Mr. Furlong has a special bulletin No. 87 describing this motorcade in detail

ONE OF TUNNELS of El Palmito Dam on Nazas River, State of Durango, Mexico, nears completion.



Trend in Hydroelectric Practice Favors

Simplified Station Design and Automatic Operating Features

W. S. MERRILL and M. G. SALZMAN, Members ASCE

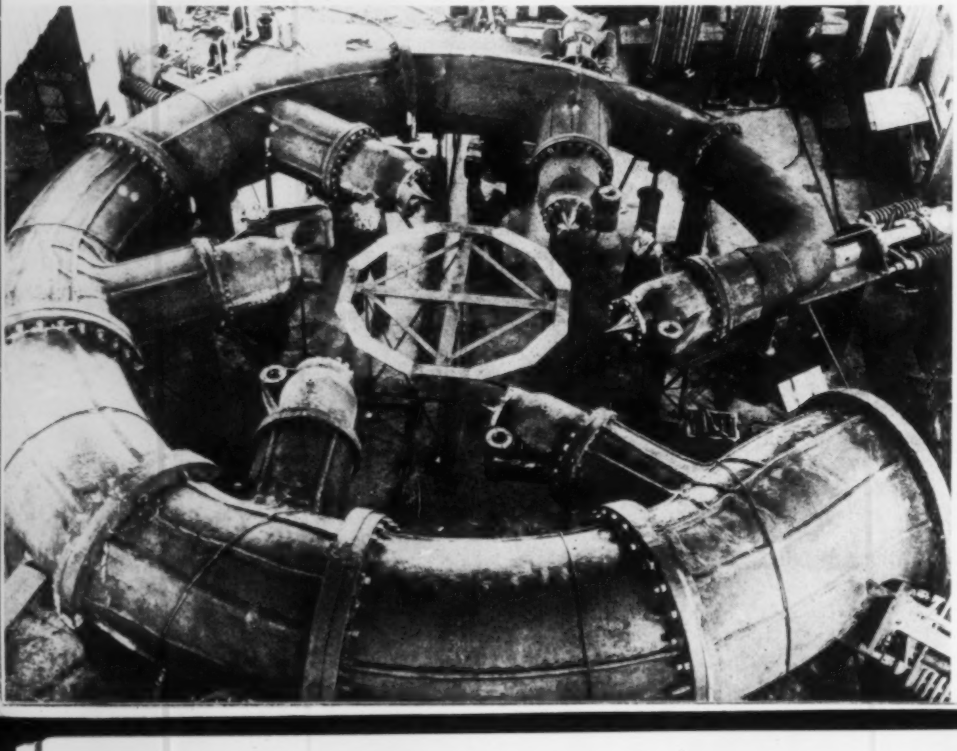
Hydraulic Engineers, Ebasco Services Incorporated,
New York, N.Y.

HYDROELECTRIC PLANT CONSTRUCTION is going on in considerable volume. At the close of the year 1948 there was estimated to be 3,500,000 kw of new water-power capacity on order for installation in the United States. Concrete gravity dams predominate although many earth and rockfill dams are also being built. Larger-capacity hydraulic turbines, operating at higher speeds for a given head, are the trend. Outdoor-type stations, designed for automatic operation and remote control have proved satisfactory from the operating standpoint and have substantially reduced operating costs. Plant designers have given attention to increasing the life of equipment and reducing maintenance costs. In this article, based on their paper before the Power Division, at the New York Annual Meeting, the authors assert that engineers should resort to more simplified design and outdoor installations with more automatic features, to meet the challenge of rising costs of labor and materials.

A LARGE PROPORTION of the hydroelectric installations now being built or contemplated are under governmental authority or district supervision, but many smaller developments are being constructed by private power companies to meet increased load requirements. The urgency of power demands necessitates the development of those projects which can be economically and speedily constructed and readily adapted to system operation. Small-capacity plants, involving minimum materials and time for completion, are frequently looked upon with more favor than large-scale developments requiring a longer construction period. Extensions to existing plants and redevelopment of old or obsolete plants where the dams and major construction are already completed, are prominent in the new-capacity installations.

Most of these new and redeveloped projects are located in the New England, North Central, Northwestern and Pacific States. In Idaho since 1947, the writers' company has designed for the Idaho Power Co. five new hydro stations with an aggregate installed capacity of 166,000 kw. In California, about 350,000 kw of hydro capacity will have been added to the Pacific Gas & Electric Company's system between 1948 and 1951.

USE OF VERTICAL IMPULSE-TYPE TURBINE conserves floor space and hence effects saving in powerhouse construction cost. Example of improved type is six-jet nozzle assembly (seen erected in shop) for 62,000-hp vertical-shaft Pelton impulse wheel installed by British Columbia Electric Railway Co. in its Bridge River Development.



It is not possible to say how much total new hydroelectric equipment will be ordered in 1949 and in subsequent years but it probably will continue to increase along with the very large amount of steam installation contemplated in the next five years. The ratio of hydro to thermal capacity has narrowed somewhat in recent years, but in 1948 about 30 percent of the total installed generating capacity in the United States was in hydroelectric plants. Government-installed hydro capacity constituted about 12 percent of the industry's total generating capacity.

In Canada, where water power predominates, representing 97.5 percent of the total electric energy consumed, about 1,500,000 kw of new hydroelectric capacity is under construction, a large amount of this being in three large projects.

Concrete Gravity Dams Predominate

The principal advances in dam construction in this country have been in magnitude, largely as the result of government multi-purpose projects. The type of dam selected is usually governed by local conditions and the materials available for construction. Dams under construction and recently built in this country in connection with power developments have been of many different types, but the concrete gravity-type dam has predominated. Artificial cooling of the concrete by refrigeration and circulating water through embedded pipes has aided in the construction of several of the large concrete dams. The present tendency is to increase the height and size of blocks for concrete pours to enable faster construction progress. Comparatively few thin arch dams have been built in recent years, although this type has considerable merit in reducing concrete materials where topographical and geological conditions make it feasible.

Several large earthfill and combination rockfill and earthfill dams are also being built. The 250-ft-high earth-faced, rockfill dam built by the Aluminum Co. of America on the Nantahala River in North Carolina involved novel methods of dam construction. The considerable thickness of earthfill placed on the upstream side of this dam provided a flexible covering that is less likely to leak under settlement of the rockfill than a more rigid facing. A drain of materials graded from fine to coarse was placed against the downstream face of the earth blanket.

Larger Water Conduits Built

There have been no startling new developments in waterway practice for hydro developments but increased size of conduits and improved methods of construction have been noted. Where the territory is not suitable for the economic construction of tunnels or canals, flumes and pipelines are used for transporting water over long distances. These are of interest mainly because of construction methods or the comparatively large size of the conduits.

An interesting example of flume construction in reverse is the recent replacement of the wooden flume which since 1904 had served the Olmsted development of the Utah Power & Light Co., near Provo, Utah, by a thin steel pipeline supported on concrete footings.

This pipeline is to operate as a gravity-flow line similar to a flume or canal and will be under pressure at only very few locations. The conduit consists of an 8-ft 6-in.-dia welded steel pipe, made of $^3/_{16}$-in. plate, with ring girders spaced 24 ft on centers. This makes the conduit a self-supporting beam between footings. The pipe was erected on simple structural steel footings which were later concreted in as part of the permanent supports. Welding for steel penstocks is being used to a greater extent on most recent construction because it facilitates field erection.

Cathodic Protection Against Corrosion

Steel pipelines and penstocks, even though well painted, often develop corrosion and pitting and sometimes require extensive repair and eventual replacement. Even the best types of coating have been found to have pinholes or breaks which enlarge with time. Corrosion of buried and submerged metallic structures has been found to correlate very closely with soil or water resistivity values. Where electrical resistivity of the soil or water is low, corrosion may proceed at a rapid rate.

SPECIALLY CONSTRUCTED ROOF protects overhead crane and generator units of Kerr Plant on Flathead River, Montana, against damage from falling rock from cliff above plant. Installation of second 56,000-kva unit is under way.

Corrosion of all types of buried or submerged pipes and other metallic structures, either coated or bare, can be reduced or eliminated by the use of cathodic protection. Protection recently designed for a 12-ft-dia buried pipeline, which has been in operation since 1923, is expected to prolong the life of the pipe for at least 25 years at an extremely nominal annual cost.

Recent changes in water-control equipment have been principally in the direction of more durable materials, structural improvements and better methods of operation. Current practice is to use roller bearings on headgates to insure more satisfactory operation. Considerable reduction in the lifting capacity of gate hoists has in some cases been effected by improved design of the bottom lip of the gate to improve the hydraulic flow conditions and thus reduce the downthrust on first opening of the gate. Welded plate-steel skin plates are being used in place of riveted sections. Where corrosion problems may arise, wearing parts are made of stainless steel. Cathodic protection to mitigate corrosion is also being employed on gate structures.

Butterfly valves are the principal type of valve used for penstock water control. Improvements have been made in the seals to insure greater watertightness. Separate rings on the disk are made adjustable to compensate for deflection and wear. One manufacturer has perfected a seal which can be adjusted from outside the valve to facilitate maintenance. Large units are being cast and built in sections for convenience of assembly.

An innovation in this country is the manufacture of a spherical valve, somewhat similar to the rotary valves built abroad. The spherical plug rotates through 90 deg and provides a smooth, undisturbed flow of water through the valve opening when wide open. It is hydraulically operated with a non-retractable seat to reduce leakage when closed.

Turbines Designed to Reduce Maintenance

The trend in hydraulic turbine design has been towards units of larger capacity and higher speed for specified heads. Manufacturers have accomplished much in improving design details and methods of fabrication. These improvements in turn have tended to reduce maintenance costs and increase reliability of operation.

Reaction-type turbines are now being considered for heads up to 1,100 ft. A noteworthy example of a high-head reaction wheel recently installed in this country is the Nantahala 60,000-hp turbine operating under a net head of 925 ft with a speed of 450 rpm. In Mexico a 39,000-hp reaction-type water wheel at the Ixtapantongo development of the Comision Federal de Electricidad is designed for a net head of 1,028 ft and a speed of 600 rpm. These high-speed reaction wheels result in smaller and less expensive generators than would be required with impulse turbines.

Adjustable-blade propeller-type turbines have also been designed for higher heads and increased speeds. The 44,000-hp turbines at the Fort Loudoun plant of the TVA, operating under a maximum head of 105 ft, are the largest now in operation. Adjustable-blade turbines rated at 110,300 hp under an 80-ft net head and a maximum head of 92 ft, are being

LARGE OUTDOOR-TYPE STATION under construction on Snake River by Idaho Power Co. is Bliss development, designed for low initial cost and economical operation. Ultimate development, pictured here, includes four 23,000-kw turbines, three of which are being installed in initial construction, which is shown in progress in February 1949 at top of facing page.

built for the Corps of Engineers' McNary Dam project at Umatilla, Wash.

New developments have also been effected in the impulse-type turbine to sustain high efficiency and improve operation. An interesting installation is the 62,000-hp vertical-type impulse wheel constructed by the Pelton Water Wheel Co. for the Bridge River Development of the British Columbia Electric Railway Co. in Canada. It is designed to operate under a head of 1,118 ft and will drive a 50,000-kva generator at 300 rpm. The turbine unit has six jets spaced around the periphery of the wheel, with the deflectors operated directly by the governor. The turbine for the one unit recently placed in operation attained a tested efficiency of 89.7 percent. Two other units are under construction and it is planned ultimately to install ten of this type in the development. The advantage of this type of turbine over the reaction wheel is a saving in powerhouse construction cost, as the vertical arrangement conserves floor space and the impulse turbine does not need the deep draft-tube excavation required for a reaction turbine.

Solid-cast impulse turbine runners, which have been installed by the S. Morgan Smith Co., have the wheel cast in one piece, enabling more buckets to be set closer to the hub than in the conventional built-up design. It is claimed that higher speeds, with lower generator cost, can thus be obtained. Buckets for the built-up impulse wheel runners are forged from plate steel or cast, using mild steel, stainless steel or other special alloy steels.

A trend in water-wheel construction is the increased use of welding, principally for spiral scroll cases, in place of the conventional cast steel and riveted plate steel casing. The spiral casing for the 100,000-hp, 208-ft-head turbine for the Shipshaw development in Canada is a notable example of welded plate-steel construction. Spiral cases of this type are being considered for heads up to 600 ft. Sections of the casing up to the limiting shipping dimensions are welded to the corresponding sections of the speed ring, which may be either of cast steel or welded plate steel.

Turbine Development to Improve Operation and Maintenance

Other improvements in the design of hydraulic turbines have been made in bearings and seal rings. A split carbon seal-ring held against the shaft by means of small garter springs is a recent development by Allis-Chalmers Manufacturing Co. to provide an effective water seal where the shaft passes through the top cover plate. The use of self-lubricated guide bearings is also being employed to provide greater reliability by eliminating the possibility of failure of mechanical lubrication. The bearing is designed to run in an oil bath and contains babbitted grooves so inclined that the rotation of the shaft produces a pumping action and forces the oil from the reservoir to the top of the bearing. For this purpose a leakproof oil reservoir is essential.

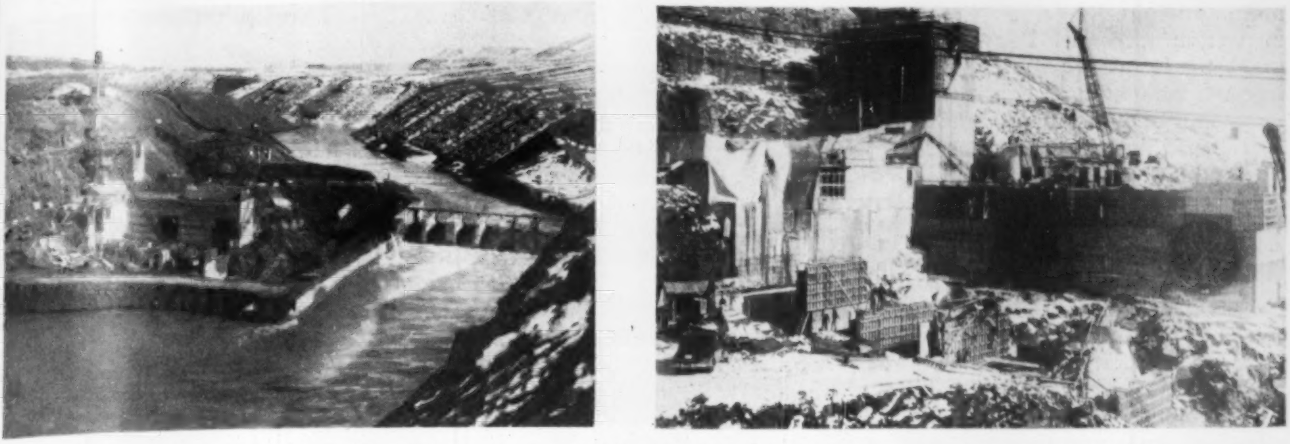
Another development which greatly reduces maintenance is automatically timed greasing of certain wearing surfaces, such as wicket-gate stem bearings, which are subject to water pressure. The spherical Kingsbury thrust bearing, which is a self-aligning combined thrust and guide bearing, was used on the Nantahala water wheel and generator. An installation of this type of bearing was made by the writers' company in 1929 for the Rosetilla plant in Mexico, and has operated successfully for many years. It is probable that more extensive use of this type of bearing will be made in the future as it eliminates one bearing and shortens the turbine shaft. Where there is the possibility of misalignment of the unit as the result of concrete "growth," self-equalizing thrust bearings are used, which have the ability to readjust themselves in case of substructure settlement.

Another recent development in turbine design, particularly of the propeller type, is the pre-welding of runner blades with stainless steel in areas subject to pitting. Solid stainless steel runners have been cast up to 20,000 lb and are being used to resist corrosion and cavitation.

Cavitation research in recent years has resulted in improved methods to determine the proper setting of hydraulic turbines above tailwater. Reaction-type runner models are now being tested in the laboratory to obtain values of sigma in the same manner as was done for propeller-type runners for a number of years. In connection with the proper setting of any given hydraulic turbine and the speed which should be used for the unit, the Engineering Department of the Baldwin Locomotive Works has developed a new method of relating sigma values of the runner to unit horsepower (power developed by a runner 1 ft in diameter operating under a head of 1 ft).

More Outdoor-Type Stations Being Built

In the United States, the outdoor and semi-outdoor types of hydroelectric power stations continue to be built in increasing numbers. The so-called "semi-outdoor" type of plant has an unhoused gantry crane over the powerhouse structure and the "outdoor" type has the generator and exciter also outside the building. The saving of cost in the construction of large, massive brick or concrete superstructures is very considerable in these days, when the labor cost for this type of work is so high. Both the outdoor and semi-outdoor types of powerplant have had the benefit of many years of service in this country and information recently obtained from many plant operators indicates their entire satisfaction with this type of construction. The fact that steam-electric plants are following the pattern set by hydroelectric plants and are being built in very considerable numbers with much of their operating equipment entirely out of doors is further proof that this



BUILDING POWERHOUSE INTEGRAL WITH DAM reduces cost of Bliss development, which will have initial installed capacity of 69,000 kw with two fixed-blade propeller-type units and one adjustable-blade Kaplan unit to provide flexibility of operation. Space is provided for fourth unit of fixed-blade type.

type of construction is reliable and economical as to cost of construction and operation.

In some cases the fully housed plant is more desirable and is being constructed for particular purposes. The Kerr plant of the Montana Power Co., on the Flathead River in Montana, is an example of this type of construction, with the superstructure enclosing crane and turbine units because of its location below a precipitous rock cliff. A specially constructed roof, consisting of heavy structural steel members supporting a 3-ft thickness of gravel, is designed to resist falling boulders. A 56,000-kva-unit extension is now being constructed at this plant, utilizing the existing dam, intake and previously constructed substructure.

Remote Control and Automatic Operation for Small Plants

To reduce operating costs, automatic features are employed in the design of plants wherever feasible. Many of the new, smaller plants are equipped for remote control or supervisory operation, with headwater-gate control, turbine-gate regulation and protective devices on the units. Only infrequent attendance by nonresident operators is necessary for emergency and maintenance purposes.

The Upper and Lower Malad developments, recently completed for the Idaho Power Co., are examples of simplified design and the use of automatic operating devices. The upper dam consists of a flat concrete slab, with a low sill supporting three large Tainter gates and providing about 10 ft of head, which is sufficient to pass 100 percent of the river into the reinforced concrete flume. At the downstream end of the flume there is an intake leading to a 225-ft-long, 10-ft-dia, welded steel penstock. At the head of the flume an automatic float-controlled Tainter gate controls the quantity and level of the water admitted to the flume. At the penstock intake another Tainter gate may be closed to unwater the penstock.

Reject-Siphon Spillway Provided

Immediately upstream from the penstock intake, a three-barrel reject-siphon spillway is located. Upon rejection of load at the power plant, the entire flow of the stream passes through this siphon and a short portion of overflow spillway adjacent to the siphon and is carried down to the river by means of a chute. The total head developed at the plant is 124 ft and the turbine installed is rated at 10,000 hp and is an Allis-Chalmers vertical Francis reaction wheel. The generator is also of Allis-Chalmers make and rated at 8,400 kva at unity power factor.

The Lower Malad development consists of a dam similar to Upper Malad Dam but with eight smaller Tainter gates which were removed from an old, obsolete development. There is a reinforced concrete flume and another Tainter gate at the penstock intake. The flume is followed by a 12-ft-diameter welded steel penstock 300 ft long. There is a reject overflow spillway located approximately halfway down the flume. The total head developed is 157 ft and the turbine, rated at 19,000 hp, is an Allis-Chalmers vertical Francis wheel. The generator is 15,500 kva at unity power factor.

Both stations are to be controlled remotely from the Lower Salmon station, with all operations, including starting and stopping of the unit, handled from the remote source. There is only one small operating room in the powerhouse; the generator is located completely outdoors and covered by a metal housing. The overhead gantry crane rides along the roof of the single operating room. The floor level of the operating room is 2 ft above the top of the scroll case.

All transformers, regulating outdoor-type installation equipment and switchgear have been placed outdoors in the switchyard adjacent to the generator. The equipment in the operating room, which is merely the space around the concrete generator barrel, consists only of the following: Governor actuator, oil pump, receiving tank and pressure tank, station air compressor, switchboard, storage batteries and rectifier, motor-driven rheostat and the generator field switch, CO_2 bottles for generator fire protection, and emergency water-turbine-driven governor oil pump. Each station is approximately 40 ft square and has sufficient space not only for the above listed equipment, but also for easy passage around the operating floor, and for routing maintenance of small equipment.

Stations Are Underground

Both stations are completely underground, with the exception of the face of the wall over the tailrace. Each station has a stairway down to a door in this wall at the operating floor level. There are no windows or other doors into the station, but there is an equipment hatch opening in the roof. Access to the under side of the runners through the draft-tube liner is by means of a ladder through a hatch in the operating-room floor. The size of this tunnel is large enough to accommodate any welding equipment used at the under side of the runner.

The unit has been so designed that it can be dismantled all the way down to the turbine wheel in a minimum amount of time if annual inspection indicates that such dismantling is necessary. An erection bay and maintenance area is provided immediately adjacent to the outdoor switchyard and the generator, and is serviced by the station crane.

Since both these stations operate at 100-percent load factor, it is the operating company's intention to provide only routine daily inspection of the plants and appurtenant hydraulic works by one man. This man will be on call for emergency duty at either plant and will be capable of handling the turbines and generators in the event of an emergency. However, he will not actually be on duty as an operator in the powerhouse.

Other Developments in Power Station Design

An example of a larger outdoor-type station, with the powerhouse integral with the dam, is the Bliss development now under construction for the Idaho Power Co. on the Snake River in Idaho.

An accompanying artist's sketch showing a cross-section of this plant as it will look when completed, indicates the economy obtained in concrete substructure and building superstructure. The transformers and outdoor-type switchgear are located on the plant roof. The simplified-unit plan of development has been adopted for this plant, with outdoor metal-clad switchgear, transformers and circuit breakers for each unit feeding into a common bus. The use of manufacturers' standard equipment and the adoption of three-phase main power transformers instead of single-phase banks have resulted in lowered electrical costs. Another feature which has reduced space requirements at the Bliss plant is the use of the crane rail as one of the two transfer car rails.

Improvements have also been made in governing and speed regulation of hydraulic turbine units. Development of the cabinet-type governor actuator has been effective in consolidating accessory equipment and promises to be more extensively used in future developments. Standardization of performance requirements and increased sensitivity of governing mechanism has done much to improve speed regulation on systems composed of plants of variable characteristics. The increased use of automatic tie-line load and frequency control equipment, and the automatic balancing of load among the units, have resulted in better intersystem operation.

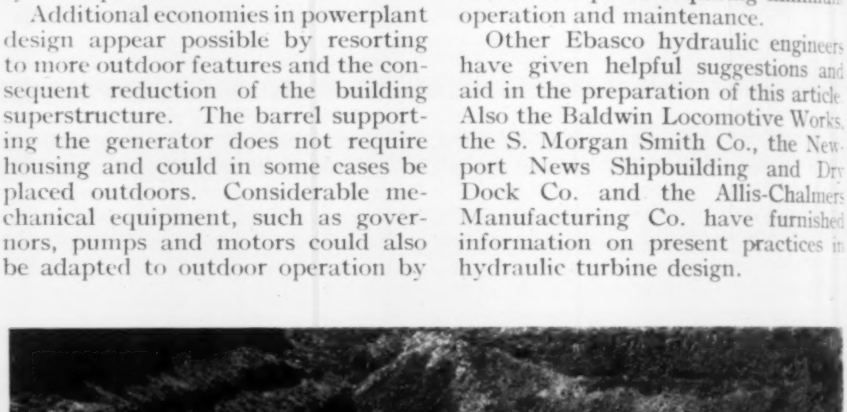
Additional economies in powerplant design appear possible by resorting to more outdoor features and the consequent reduction of the building superstructure. The barrel supporting the generator does not require housing and could in some cases be placed outdoors. Considerable mechanical equipment, such as governors, pumps and motors could also be adapted to outdoor operation by specifying suitable weatherproof enclosures.

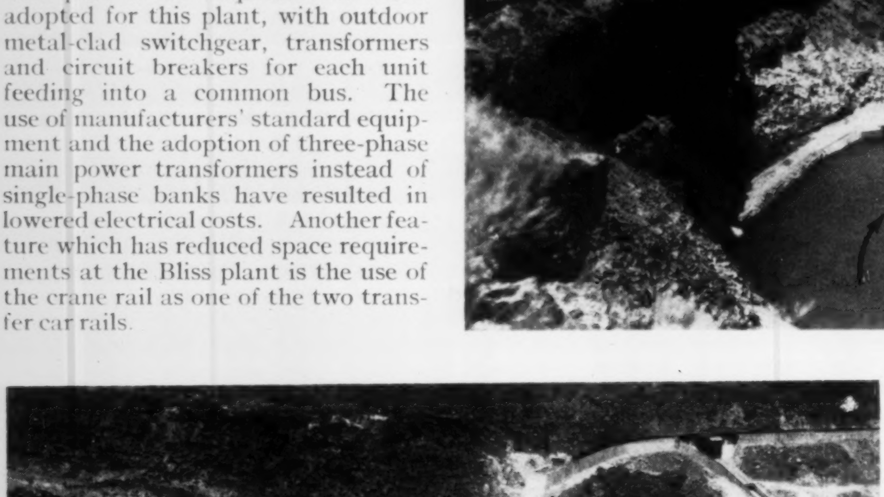
More automatic features will undoubtedly continue to be employed wherever possible, to reduce operating costs and increase reliability.

Challenge to Resourcefulness of Engineers

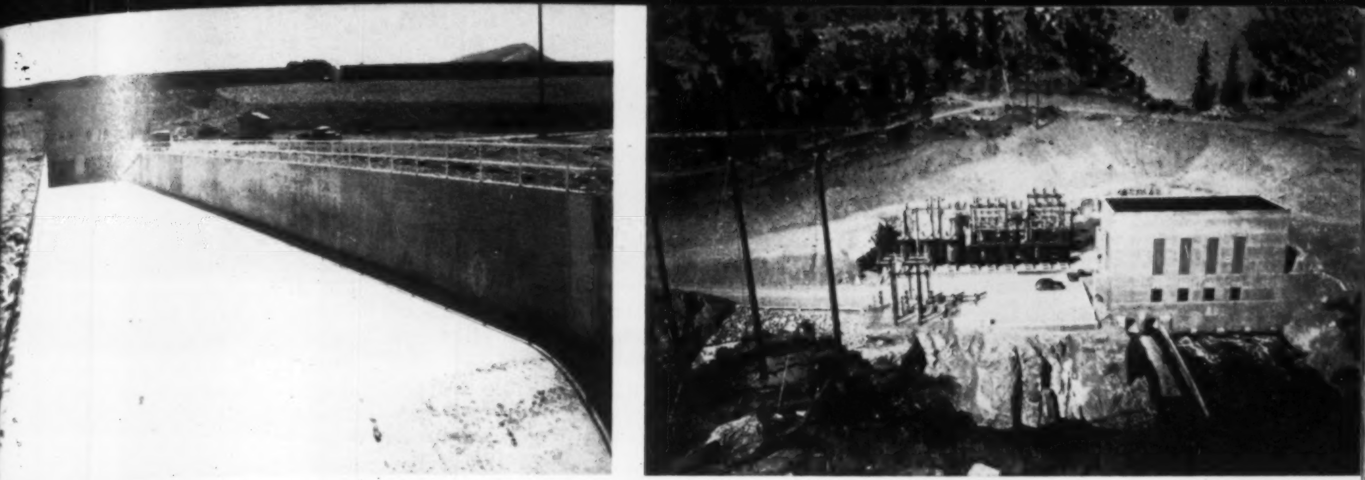
The situation arising from present high labor and material costs challenges the resourcefulness and ingenuity of engineeers and designers of hydro plants. It is incumbent upon them to take advantage of all possible means to reduce investment and over-all production costs. The interests of the client operating company can best be served by producing a low-cost plant requiring minimum operation and maintenance.

Other Ebasco hydraulic engineers have given helpful suggestions and aid in the preparation of this article. Also the Baldwin Locomotive Works, the S. Morgan Smith Co., the Newport News Shipbuilding and Dry Dock Co. and the Allis-Chalmers Manufacturing Co. have furnished information on present practices in hydraulic turbine design.





SIMPLIFIED DESIGN and automatic operating devices mark Upper and Lower Malad developments of Idaho Power Co. In upper development here pictured, river is diverted into flume, seen in view at right above, which follows grade contour to 10,000-hp outdoor-type turbine, shown in view at left, which operates under 124-ft head. At Lower Malad plant, not pictured, 19,000-hp turbine unit operates at 157-ft head. No operators are required. Plants are remotely controlled, including stopping and starting from another plant. In both plants, when load on turbine is rejected, water in flume automatically spills down chute to river.



GREEN MOUNTAIN POWER HOUSE (above left), at western end of Colorado–Big Thompson Project, will be interconnected with power plants on eastern slope to supply power for pumping water from Granby Reservoir up to Grand Lake and for sale from transmission system. Water discharging from outlet works of Horsetooth Dam (above, right) will be carried via Poudre Supply Canal to augment supply of irrigation water in northeastern Colorado.

Colorado–Big Thompson Project Irrigates 600,000 Acres, Generates 600 Million Kwhr

L. N. McCLELLAN, M. ASCE

Chief Engineer, Bureau of Reclamation, Denver, Colo.

DIVERTING WATER from the west side of the Continental Divide, the Colorado–Big Thompson Project will provide for irrigation and power in northeastern Colorado, east of the Rockies. The project, now more than 50 percent complete, can be divided into three main elements: Collection, storage, power, and pumping structures west of the Continental Divide; a 13-mile tunnel under the Divide capable of carrying 550 cfs; and the irrigation and power facilities east of the Divide. The completed project will irrigate 600,000 acres of farm land, and generate about 600 million kwhr of firm electrical energy annually. In the following article, Mr. McClellan, who has been associated with the U.S. Bureau of Reclamation almost continuously since 1911, presents the construction features of this important trans-mountain diversion project.

CONSTRUCTION OF the Colorado–Big Thompson Project is more than 50 percent completed, with many of the major features of this far-flung transmountain diversion development now finished or nearly so. However, before the project is ready for full operation, a variety of structures and facilities ranging from dams and canals to power plants and transmission lines still remain to be built. Now in its eleventh year of construction, the project has been delayed by restrictions during World War II and later by war-created shortages and attendant increases in construction costs.

The project will divert water from the headwaters of the Colorado River on the western slope of the Continental Divide to lands on the eastern slope of the Rocky Mountains in northeastern Colorado to supplement the present inadequate irrigation supply and to develop hydroelectric power. This transmountain diversion of western-slope water will assure a more equitable distribution of the available water supply as well as provide greater economic stability through reduction in drought hazards, increase in crop production, and generation of electric power.

Irrigators in northeastern Colorado recognized as early as 1890 that arable lands adjacent to available streams were rapidly becoming utilized, and that new lands could be brought under irrigation only if supplementary water could be obtained from the western slope of the Rocky Mountains. It was not until 1935, however, that impetus was given the diversion scheme by an allotment of

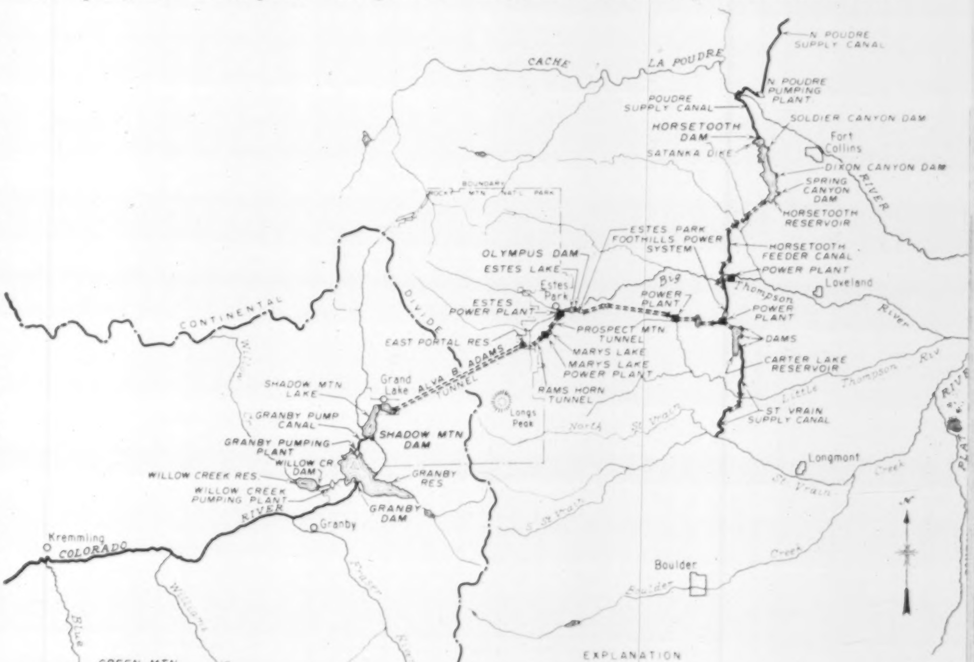

N POUDRE SUPPLY CANAL
CACHE
LA POUDRE
N POUDRE PUMPING PLANT
POUDRE SUPPLY CANAL
SOLDIER CANYON DAM
HORSETOOTH DAM
SATANKA DIKE
Fort Collins
DIXON CANYON DAM
RIVER
SPRING CANYON DAM
HORSETOOTH RESERVOIR
BOUNDARY
ROCKY MTN NAT'L PARK
ESTES PARK FOOTHILLS POWER SYSTEM
OLYMPUS DAM
ESTES LAKE
HORSETOOTH FEEDER CANAL
POWER PLANT
Loveland
Estes Park
Big
Thompson
River
ESTES POWER PLANT
POWER PLANT
POWER PLANT
CONTINENTAL
DIVIDE
EAST PORTAL RES
PROSPECT MTN TUNNEL
MARYS LAKE
MARYS LAKE POWER PLANT
DAMS
CARTER LAKE RESERVOIR
Little Thompson Riv
ALVA B. ADAMS TUNNEL
Grand Lake
SHADOW MTN LAKE
RAMS HORN TUNNEL
Longs Peak
North St Vrain
ST VRAIN SUPPLY CANAL
GRANBY PUMP CANAL
SHADOW MTN DAM
GRANBY PUMPING PLANT
WILLOW CR DAM
Longmont
WILLOW CREEK RES
GRANBY RES
WILLOW CREEK PUMPING PLANT
St Vrain Creek
RIVER
GRANBY DAM
Granby
Kremmling
COLORADO
Boulder
Boulder Creek
Williams Fork River
Fraser River
Blue River
PLATTE RIVER
POWER PLANT
GREEN MTN. DAM
GREEN MTN RESERVOIR
EXPLANATION
CANAL
TUNNEL
SIPHON
POWER PLANT
PUMPING PLANT
5 0 5 10
SCALE OF MILES
DENVER

FIG. 1. COLORADO–BIG THOMPSON PROJECT collects runoff from west side of Continental Divide and distributes it to dry areas east of Divide. Project demands close coordination of power and irrigation facilities.

$150,000 from the Public Works Administration for investigation work. The Colorado–Big Thompson Project was approved by the President in July 1937, and an appropriation of $900,000, to begin construction, was made by Congress in the same year.

Primarily, the project is to furnish supplemental water for the irrigation of about 600,000 acres of farm land in the valleys of the Big and Little Thompson, Cache la Poudre, St. Vrain, Boulder, and South Platte Rivers, which are now under cultivation but which have an inadequate water supply. The irrigation features of the project comprise three principal elements: (1) A coordinated system of storage facilities on the western slope of the Rocky Mountains which are to collect and retain surplus water of the Colorado River; (2) a 13-mile tunnel under the Continental Divide, which is the artery to transport the western-slope waters to the eastern slope; and (3) a system of storage reservoirs on the eastern slope which, together with canals and other structures, are to equalize and distribute the supplemental water to the lands in the Northern Colorado Conservancy District.

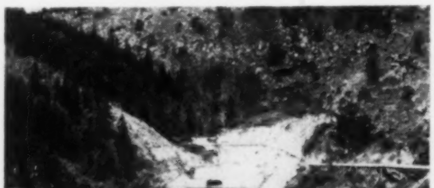
Coupled with the primary purpose of furnishing additional irrigation water, is the secondary function of this multiple-purpose project—the annual generation and transmission of about 600 million kwhr of firm electrical energy. The generation of much of this power is made feasible by the topography of the region, which provides a 2,800-ft drop in elevation between the eastern terminus of the Adams Tunnel and the storage reservoirs on the edge of the plains, 22 miles distant.

Western-Slope Structures

With the exception of Granby Dam and Granby Pumping Plant, the principal structures and storage facilities on the western slope of the project are completed. These include Green Mountain Dam and Green Mountain Power Plant, which were completed in 1943. The dam, which is the largest on the project, is an earthfill structure having a maximum height of 309 ft and a total volume of 4,370,000 cu yd. The powerplant houses two 12,000-kw generators, which are capable of ge erating nearly 60 million kwhr a nually. Green Mountain Reservo which has an active capacity of 147, 000 acre-ft, stores the spring runoff o the Blue River, a tributary of th Colorado, and thus provides com pensatory storage for the wester slope for water diverted to the easter slope. Construction of the Gree Mountain Dam and Power Plant wa expedited during the early part o World War II to insure an adequat power supply for vital defense indus tries in the Rocky Mountain area.

The principal storage facility on th western slope is Granby Reservoi which is to provide an active storag capacity of 468,000 acre-ft. Th reservoir, the second largest in Colorado, is formed by Granby Dam acros the Colorado River and by four dike adjacent to the dam. The dam, now about 80 percent complete, is an earthfill structure 296 ft in height.

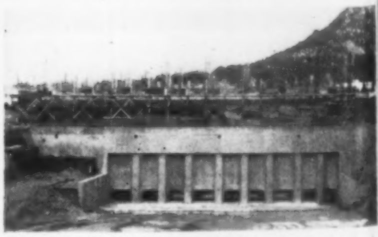
As Granby Reservoir is at a lowe elevation than the Adams Tunnel, a large pumping plant is required to lift the stored water so that it can flow through the tunnel by gravity. Granby Pumping Plant will lift water a maximum of 186 ft from Granby Reservoir into Shadow Mountain Lake, an extension of Grand Lake, to permit gravity flow of water from



EAST PORTAL RESERVOIR, ALVA B ADAMS TUNNEL

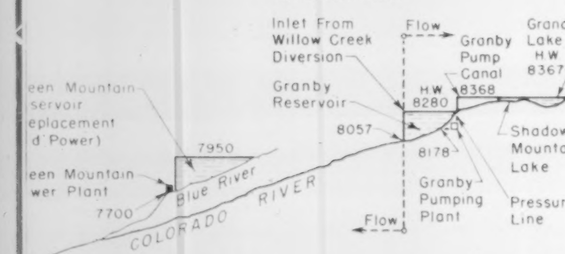
PENSTOCK–MARYS LAKE POWER PLANT

GRANBY DAM



SUBSTRUCTURE, ESTES POWER PLANT

FIG. 2. **PROFILE** of Colorado–Big Thompson Project indicates large head available east of Continental Divide. Power developed west of Divide pumps water sufficiently high to permit gravity flow through transmountain Alva B. Adams Tunnel.



een Mountain
servoir
eplacement
d' Power)
7950
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wer Plant
7700
Blue River
COLORADO RIVER
Inlet From
Willow Creek
Diversion
Flow
Granby
Pump
Canal
Granby
Reservoir
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8280
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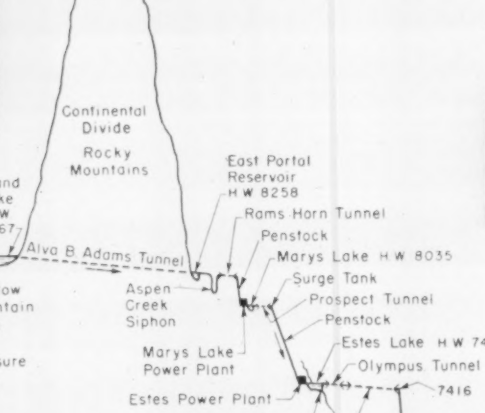
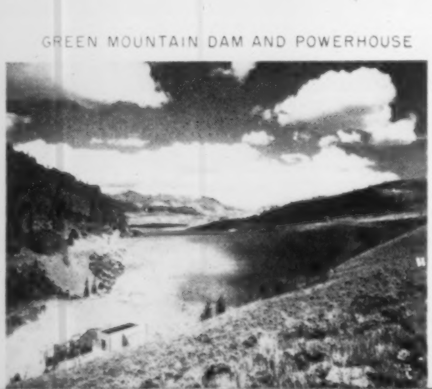
Shadow
Mountain
Lake
Granby
Pumping
Plant
Pressure
Line
Flow

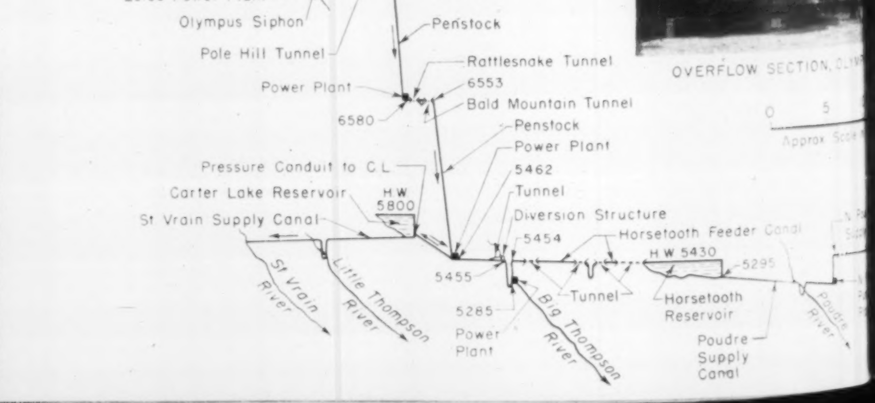


Grand
Lake
H W
8367
Alva B Adams Tunnel
Sumit El
Approx 12,000
Continental
Divide
Rocky
Mountains
East Portal
Reservoir
H W 8258
Rams Horn Tunnel
Penstock
Marys Lake H W 8035
Surge Tank
Prospect Tunnel
Penstock
Aspen
Creek
Siphon
Marys Lake
Power Plant
Estes Lake H W 7475
Olympus Tunnel
7416
Estes Power Plant
Olympus Siphon
Penstock
Pole Hill Tunnel

OVERFLOW SECTION, OLY

GREEN MOUNTAIN DAM AND POWERHOUSE





Rattlesnake Tunnel
Power Plant
6553
6580
Bald Mountain Tunnel
Penstock
Power Plant
5462
Tunnel
Pressure Conduit to C L
Carter Lake Reservoir
H W
5800
St Vrain Supply Canal
Diversion Structure
5454
Horsetooth Feeder Canal
H W 5430
5295
5455
Tunnel
Horsetooth
Reservoir
5285
Power
Plant
St Vrain
River
Little Thompson
River
Big Thompson
River
Poudre
River
Poudre
Supply
Canal
0
5
Approx Scale

SHADOW MOUNTAIN DAM increases capacity of Grand Lake which stores water for diversion through Alva B. Adams Tunnel. Water from Granby Reservoir is pumped up 186 ft into Grand Lake for transmission to eastern slope of Rocky Mountains.

CONSTRUCTION OF GRANBY DAM is about 80 percent completed. The dam, which stands 296 ft high, forms second largest reservoir in Colorado, with active storage capacity of 468,000 acre-ft.

Grand Lake into the tunnel. The pumping plant is a 188-ft-high reinforced concrete structure located on the north shore of Granby Reservoir. It will contain three vertical-shaft pumps, driven by 6,000-hp motors, each of which will be capable of delivering 200 cfs under a maximum operating head of 186 ft. Additional integral features required to accomplish the lift are a reinforced concrete intake structure; three reinforced concrete intake conduits, 87 in. in diameter, which lead to the pumping plant from the intake structure; three concrete-encased 87-in.-dia steel discharge pipes which lead from the plant through a concrete-encased steel wye to a discharge conduit; and the 11-ft-dia 3,500-ft-long reinforced concrete discharge conduit. A 1,100-cfs canal, 1.8 miles long, extends from the discharge conduit of the Granby Pumping Plant to Shadow Mountain Lake.

In effect, Shadow Mountain Lake is an extension of Grand Lake created by the construction of a small earth- and rockfill dam across the North Fork of the Colorado River. Shadow Mountain Lake will serve three important functions in the operation of the system: (1) Regulate flow through the Adams Tunnel to suit the power and irrigation requirements; (2) permit the Granby Pumping Plant to be operated during offpeak hours of power demand and thus increase the firm power available for sale; (3) maintain the level of Grand Lake within prescribed limits. In addition, the reservoir has saved a considerable length of canal which otherwise would have had to be built to transport the water from Granby Pumping Plant to Grand Lake.

The Alva B. Adams Tunnel is the outstanding engineering feature of the Colorado–Big Thompson Project. It is the largest irrigation tunnel in the world and the longest tunnel in the United States to be driven from two portals without intermediate adits or shafts. This 13.06-mile-long tunnel serves as the connecting link between the western and eastern slopes. Excavation was begun in June 1940 and completed in June 1944. This period included a nine-month delay during the war due to lack of materials and a shortage of manpower. The tunnel slopes from west to east on a grade of 0.155 ft per 100 ft, making the east portal 107 ft lower than the west portal. It is lined with concrete to a finished circular section of 9.75-ft diameter.

The first diversion through the tunnel was made in June 1947 for dedication ceremonies only. A short time later small flows were diverted to relieve a threatened shortage of irrigation water on the eastern slope. The diverted water was carried from the tunnel through a pipeline constructed by the water district to permit partial delivery of water until completion of the permanent conveyance works.

Eastern-Slope Structures

Although completion of the Adams Tunnel was a major accomplishment in the project, the tunnel will not function to capacity until permanent east-slope conveyance and storage structures have been completed. These works, in sequence as the water descends the eastern slope, are East Portal Reservoir, Aspen Creek Siphon, Rams Horn Tunnel, Marys Lake Penstock, Marys Lake Power Plant, Marys Lake Reservoir, Prospect Mountain Conduit, Prospect Mountain Tunnel, Estes Power Plant Penstocks, Estes Power Plant, and Olympus Dam.

The East Portal Reservoir, formed by a 78-ft-high concrete corewall and rockfill dam, provides an overflow emergency spillway into the Wind River, a tributary of the Big Thompson. The next feature is the Aspen Creek Siphon, a reinforced concrete conduit 10.75 ft in diameter and 1.32 miles long. It is designed to carry the full-capacity flow of 550 cfs.

The Aspen Creek Siphon connects with the Rams Horn Tunnel, a concrete-lined horseshoe-shaped tunnel 10 ft in diameter and 1.31 miles in length, which connects with the Marys Lake Penstock, a welded steel pipe of 96-in. diameter. The Marys Lake Power Plant, now under construction, is a reinforced concrete structure which will contain one main generating unit of 8,100-kw capacity.

Water discharging from the power plant enters Marys Lake Reservoir, a small reservoir created by two earthfill dikes which increase the storage capacity of Marys Lake. The reservoir will serve as an afterbay for Marys Lake Power Plant, as well as a

PLACING OF EARTHFILL for Horsetooth Dam nears completion. When finished, dam will stand 125 ft high and have crest length of 1,600 ft. Horsetooth is one of four dams and one dike which will form Horsetooth Reservoir.

WELDED STEEL PENSTOCKS of 78-in. diameter can carry capacity flow of 1,300 cfs from Prospect Mountain Tunnel to Estes Power Plant. These penstocks, ¾ miles long, have design operating head of 510 ft.

forebay reservoir for the Estes Power Plant. The Prospect Mountain Conduit and the Prospect Mountain Tunnel connect the Marys Lake Reservoir with the upper end of the Estes Power Plant penstocks. This section of the conduit is composed of 3,000 ft of reinforced concrete pressure conduit and 1.06 miles of 12.5-ft-dia tunnel. A feature of the Prospect Mountain Tunnel is a 50-ft-dia, reinforced concrete vertical surge tank, 100 ft high. The surge tank provides a means of controlling the surge of water following the closing of the gates at the Estes Power Plant turbines, as well as preventing water hammer in the penstocks.

The Estes Power Plant penstocks consist of three 78-in.-dia, 0.75-mile-long steel pipes which operate under a maximum head of about 510 ft.

The Estes Power Plant is located on the south bank of the Big Thompson River about a half mile below the village of Estes Park. This 98×145-ft reinforced concrete structure will contain three 15,000-kw generating units driven by 21,000-hp reaction-type turbines. Water from the power plant will discharge into Estes Lake created by the Olympus Dam, a concrete gravity-type spillway dam with an earth embankment extending from the concrete section across the channel of the Big Thompson River to the left abutment. This structure has a maximum height above river bed of 56 ft. The Estes Lake will serve to reregulate the discharge from the Estes Power Plant and provide a uniform flow of water to the power plants below that point. Water from this reservoir can be discharged into the Big Thompson River until such time as the conduits and power plants farther down the slope are completed.

DIXON CANYON DAM, one of four earthfill structures that enclose Horsetooth Reservoir, has height of 240 ft and length of 1,000 ft. In photo dam is already topped out, with only riprap on upstream face, and rockfill on downstream slope, remaining to be placed.

The remainder of the system of power plants, tunnels, penstocks, and appurtenant structures linking Estes Lake with the foothills reservoirs will be completed as rapidly as funds are appropriated by Congress. Two power plants having a total installed capacity of about 70,000 kw, are planned. The total head utilized will be about 2,000 ft.

Storage in Foothill Reservoirs

After passing through the power plants, the water will be delivered to and stored in the foothill reservoirs. Horsetooth Reservoir, about 4 miles west of Fort Collins, Colo., will store 147,000 acre-ft of the western-slope water. The reservoir will have a maximum surface area of about 1,870 acres and will be about 6.5 miles long, varying in width from 0.25 to 0.75 miles.

Situated between two parallel rocky ridges or hogbacks running in a north-south direction, Horsetooth Reservoir is formed by four earthfill dams and one dike, and has a total volume of about 10,376,000 cu yd. The eastern hogback is cut by three small streams and these breaches are the sites of the Soldier Canyon, Dixon Canyon, and Spring Canyon Dams. The north end of the reservoir is closed by Horsetooth Dam and Satanka Dike.

Spring Canyon, Soldier Canyon, and Dixon Canyon Dams are of similar size, each having a maximum height of slightly more than 200 ft and a crest length of slightly more than 1,000 ft. Horsetooth Dam is 125 ft in height and has a crest length of 1,600 ft.

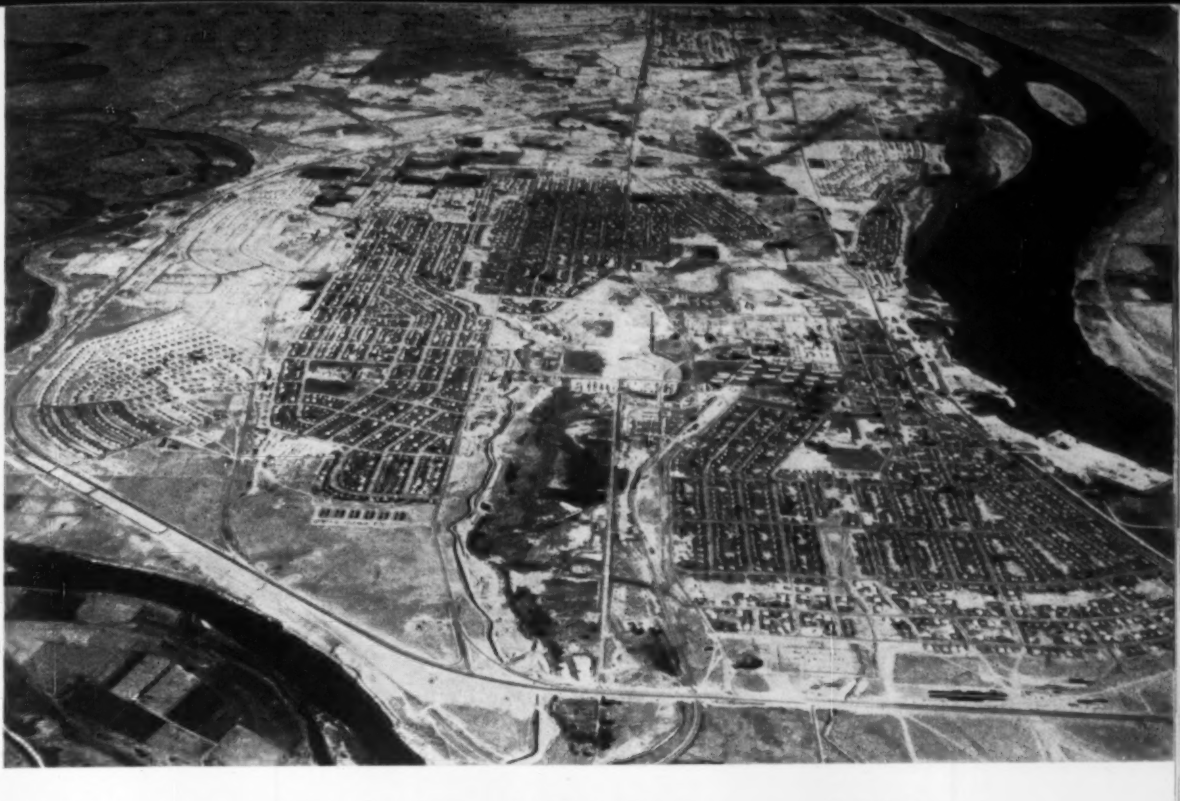
An outlet for the reservoir, under the center of Horsetooth Dam, consists of a single 8.5-ft-dia concrete opening and two horseshoe outlet pipes 10 ft in diameter. A 6-ft-dia steel penstock has been installed in each of the horseshoe conduits. These penstocks will discharge water from the reservoir into the Poudre Supply Canal, which will deliver it to the northern area of the irrigation district via the Cache la Poudre River. An additional outlet for the reservoir is to be provided by a tunnel running through the rock abutment of Soldier Canyon Dam which will carry up to 80 cfs.

Water will enter the Horsetooth Reservoir through the Horsetooth feeder canal, which under present plans is to carry water diverted from a temporary structure to be constructed on the Big Thompson River about 13 miles west of Loveland, Colo. In its entirety, the canal will consist of concrete-lined open sections, five tunnels, flumes, transitions, and siphons, totaling about 13 miles in length. The tunnels are concrete lined and have a horseshoe section 10.5 ft in diameter designed to carry a capacity flow of 550 cfs.

Specifications have been issued recently for the construction of earthwork, concrete lining, and structures for 10 miles of the canal. These specifications also include the construction of six concrete siphons and the placing of one steel siphon. The remaining tunnel and appurtenant features, which will serve as the initial intake structures at the point of diversion on the Big Thompson River, are to be placed under construction this summer.

The extensive power development of the Colorado–Big Thompson Project is to be operated in close correlation with the irrigation requirements of the project. Proper scheduling and accurate control of water throughout the entire irrigation system will be necessary to meet the daily variations in power load. For example, on the western slope, Green Mountain Power plant will be operated to furnish peaking capacity in conjunction with the irrigation and replacement releases from Green Mountain Reservoir. This power plant will be interconnected with the other power plants of the project by high-tension transmission lines.

(*Continued on page 95*)



ATOMIC CITY of Richland, Wash., builds toward permanent population of 25,000. New housing areas appear at extreme left, along Yakima River, and at upper right, along Columbia River. Highway around city at left is new bypass arterial leading to North Richland, construction camp, from twin cities of Pasco and Kennewick, Wash.

Atomic Energy Town of Richland, Wash., Grows from 250 to 25,000 Population

DAVID J. BRUMLEY, Assoc. M. ASCE

Civil Engineer, Atomic Energy Commission,
Richland, Wash.

HANFORD Works is one of three major installations of the country's atomic energy program. Covering an area of 631 sq miles in southeastern Washington, the site was selected because of an abundant electric power supply and the availability of cold water. The Columbia River, which traverses the entire area, has an average flow of 115,000 cfs and, since the construction of Grand Coulee Dam, a minimum of 23,000. Other important factors in site selection were the isolation of the area and the small number of residents to be displaced. The several plants produce plutonium, a radio-active element which is basic both to bombs and to other applications of atomic energy. In the process the raw material, uranium, is subjected to neutron bombardment in a "pile." One of the special problems in the manufacture of plutonium is the disposal of radioactive wastes, which was described by A. E. Gorman, M. ASCE, in March 1949 CIVIL ENGINEERING.

THREE TOWNS have been associated with the development of Hanford Works on the Columbia River in the State of Washington: Richland, which is located in the southeast corner of the area; North Richland, site of the present construction camp, four miles north of Richland; and Hanford, some 25 miles up the river from Richland.

Ground was broken for the original construction in March 1943. Until January 1947 the project was under the direction of the Manhattan District of the Corps of Engineers, which contracted the work to E. I. du Pont de Nemours & Co. Hanford, site of the original construction camp, by November 1944 had grown from 500 to 51,000. Over 45,000 workers were employed and about this time the first atomic pile was placed in operation. In January 1947 the Atomic Energy Commission replaced the Corps of Engineers and assumed management of Hanford Works.

Only the instigators of the original construction can recall the former town of Richland, inhabited by 250 people who farmed asparagus fields, fruit orchards and vineyards in the alluvial valley. Located immediately above the confluence of the Yakima and Columbia Rivers, the area has a semiarid climate where irrigation is essential for the growth of vegetation.

When the first construction program was started in 1943, housing and commercial facilities for the workers and their families were immediately required. Every use was made of the original town. However, of the 185 existing buildings only 60 were considered suitable for future occupancy. Six commercial buildings have been converted into permanent stores and the better residences have become homes for project employees.

To house an initial population of 7,750, a total of two thousand units were planned, but even before these could be completed an expanded schedule for a population of 16,000 was predicted for the plutonium plant. At the end of the war some 15,000 persons occupied the 4,000 dwelling units in Richland. During the summer of 1947, a $500,000,000 expansion program was started and immediate steps were taken to provide additional dwellings for the rapidly expanding personnel.

Initial Housing Development

Housing for construction workers was of prime concern and a survey of unoccupied buildings was made. Thirty-one four-wing barracks were moved from the original construction camp in Hanford to prepared foundations in North Richland. Further investigation revealed that many buildings at the Pasco Naval Base

SAND BAGS AND FILL (top view) form 5,800-ft-long temporary dike to protect Richland during 1948 flood. River rose 1.5 ft after photograph was taken. Dike, called "Miracle Mile," was constructed in three days by fleet of equipment, some of which appears in view immediately above.

across the Columbia River were available for immediate occupancy. Moving the two-story barracks posed quite a problem. Each 30×80-ft building had to be placed on special dollies and transported 10 miles to a barge on the east bank of the river. After a one-mile trip up and across the river the buildings were moved four miles overland to concrete foundation piers in North Richland. Even though the river trips were postponed several times during high winds, the moving took only 11 weeks.

Realizing that construction workers who have their families with them are more content and permanent, the Atomic Energy Commission authorized the moving of 222 prefabricated dwelling units from Bremerton to sites overlooking the river. More than 2,200 trailer spaces were constructed complete with electric, water and sewerage facilities, trailer shelters and bath and laundry buildings. Housing at North Richland was filled as rapidly as completed. Each worker had the added incentive of providing shelter for his co-workers and himself.

Construction of warehouses and shops in North Richland was begun immediately. A complete hospital was moved from the Naval Base, and quonset huts were connected to form an excellent school. Stores, theaters and other recreational facilities were provided for the peak construction population of 13,000.

Central Heating System Provided

Central heat for the 1947–1948 season was provided by a temporary installation of 21 hand-fired boilers. In December 1948, two 100,000-lb-per-hr boilers using pulverized coal (complete with feedwater treatment, mechanical ash disposal and continuous blowdown) replaced the battery of temporary boilers. An extension of the Richland distribution system provided an immediate water supply, and a temporary Imhoff tank was constructed for treating sewage until a trunk sewer to Richland could be completed.

Additional office space in Richland for the General Electric Co. (the Atomic Energy Commission's prime contractor), the architect-engineers and consultants was provided by moving two buildings from the Naval Base.

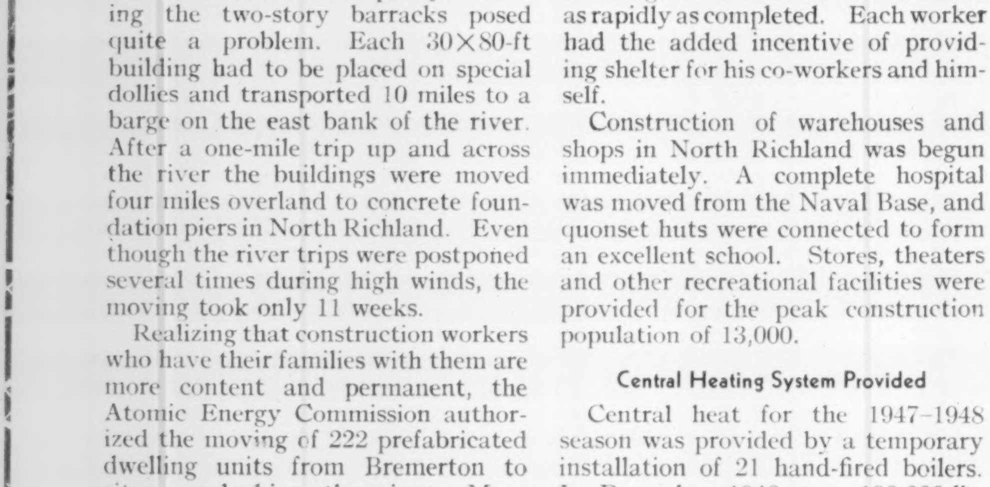
Permanent dwelling units were begun in the Fall of 1947. Since then, nearly 2,000 have been completed. The majority are two-, three- and four-bedroom houses, but 64 apartments and additional dormitories were included in the program. The wood-siding, asbestos-shingle and concrete-block exteriors provide variety. Inverted floor plans were used in many cases and occasionally houses were angled to the street line. A variety of colors was used in the trim and shingles. All new housing areas are served by paved streets complete with concrete sidewalk, curb and gutter. A rolled-type curb permits easy access to any future private driveways.

Recharging Basins Replenish Well Water Supply

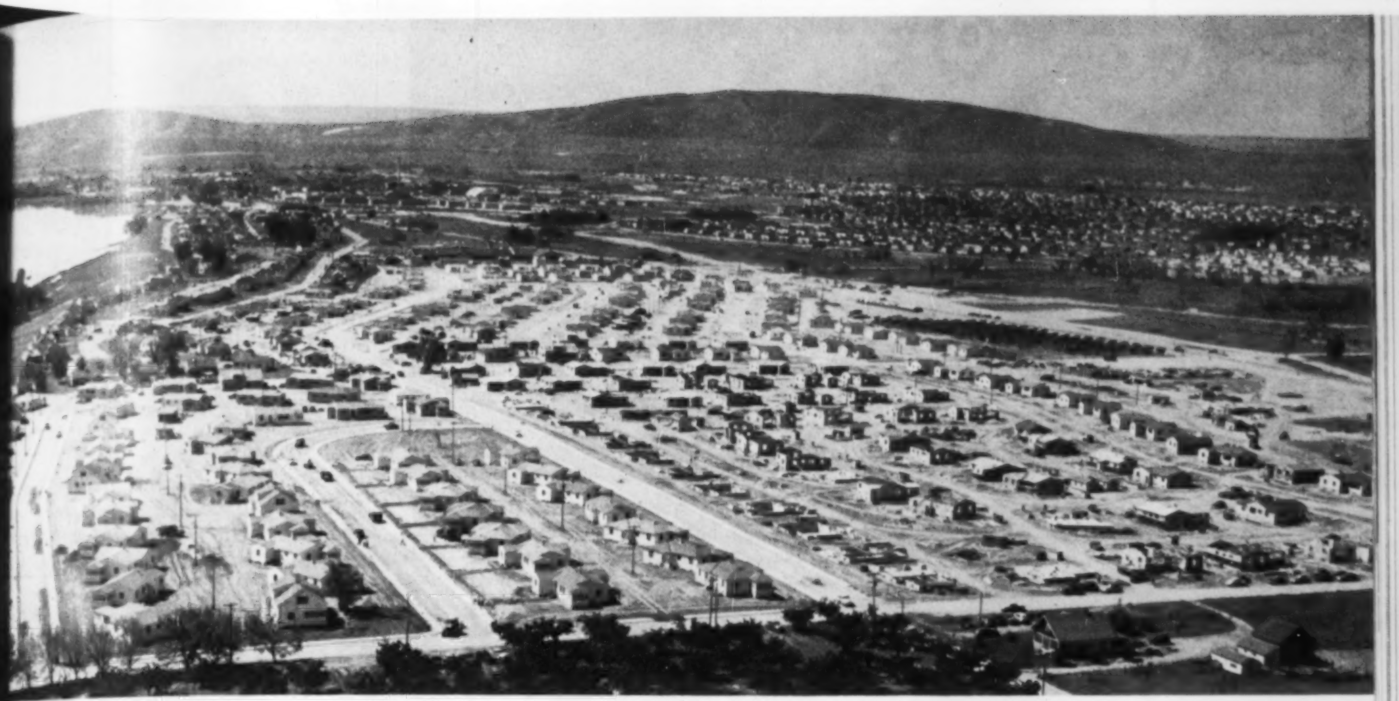
Greatly expanded water treatment and distribution facilities were necessary for the rapidly growing communities of Richland and North Richland. In addition to the normal sanitary demand, over 2.5 times that amount is necessary for irrigation of public areas and lawns and for air coolers.

In the fall of 1947 a deficit of 8 mgd was predicted by June 1948, and Alvord, Burdick and Howson were engaged as consulting engineers. Within a space of several months the problem was solved by developing two recharging basins. A pervious gravel formation near the surface of the ground provides an excellent filter media from which water can be pumped through shallow wells. The supply to the wells is replenished by flooding the basins from the Yakima or Columbia Rivers.

The area between the two communities was the logical location for add-



PILE FOUNDATIONS ARE PLACED for 130-ft double-lane Bailey span to bridge gap made in center of highway trestle across Yakima River. Gap was made to protect structure against ice jam which extended three miles upstream from bridge during unseasonably cold weather in February 1949. Dolphins 15 ft upstream from each pile foundation protect them from ice and driftwood.



TWO THOUSAND DWELLING UNITS constructed in past 18 months relieve housing shortage in Richland, Wash., administrative center of Atomic Energy Commission's Hanford Works. In foreground (above) are two-, three-, and four-bedroom units. Columbia River appears at left. Heavy equipment (right) rough grades top soil around ranch-type houses for future lawns and gardens to be planted and maintained by tenants.

ing to the distribution system. Two idle gravel pits were immediately available after some grading of the side slopes. The northerly area (with 6 mgd capacity) furnished water to the one-million-gal ground storage reservoir in North Richland, while the discharge line from the southern area (also with 6-mgd capacity) was connected to a new two-million-gal reservoir and also to the distribution loop between Richland and North Richland.

The 50- to 70-ft wells around the recharging basin are connected to a collection loop. Water is chlorinated and then pumped to the supply lines. As new housing areas were developed on the fringes of the village, the existing distribution grid was insufficient to carry the increased quantities. Trunk mains from the new loop between the village and the construction camp proved more economical than increasing the distribution mains from the existing filter plant in the center of the original population. Further study will be required to equalize pressures in portions of the expanded village.

Service to 1,000 dwelling units now nearing completion and to additional commercial facilities will overload the water supply developed to meet last summer's peak demand. A study and design are under way to provide water for these areas. The new Central Commercial Area covering a square block is now under construction and this enterprise will require water facilities.

The estimated maximum water demand for 1949 is 20 mgd. It is interesting to note that an estimated 75 percent of the total is required for irrigation and for air coolers. Irrigation for the major portion of the original town is provided through six independent distribution systems from pumps located along the main irrigation ditch. Although the water receives nominal chlorination, there is always the possibility of a cross connection with the sanitary system or that children will drink from the hose bibs. The maintenance and operation of the six pumping stations and the frequent replacement of "war-quality" pipe is proving uneconomical. In the new housing areas a single distribution system provides both domestic and irrigation water and the conversion of the entire village to a "single system" is under study.

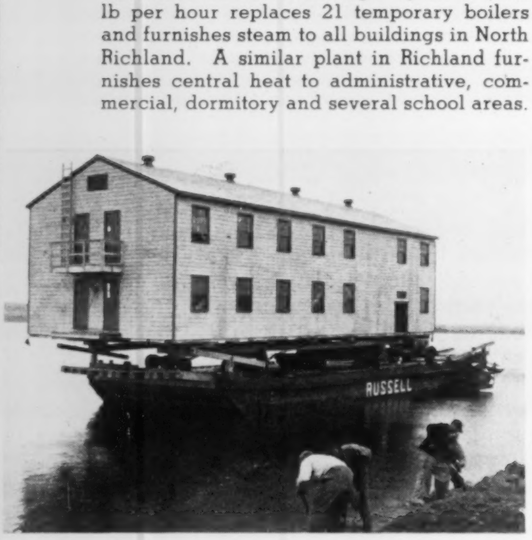
The rapid completion of the construction camp necessitated temporary sewage treatment facilities. A large Imhoff tank served until October 1948, when a 4.5-mile trunk sewer was completed to the village lift station. Through this lift station is pumped the sewage from North Richland and approximately three-fourths of the flow from Richland. Increased pumping capacity was developed through replacing the 14-in. force main with a 30-in. line and by changing impellers on the existing pumps.

An additional sewage treatment plant of 4.53-mgd capacity (maxi-

TRACTOR CRANE PLACES part of 100,000-gal overhead water storage tank which was brought in sections from Hanford, reconditioned, and erected as part of North Richland's water supply system.

MAIN ACCESS ROAD to Richland (right and upper center) passes close by sewage treatment plant, addition to which, seen in center background, now nears completion. Finished plant will serve combined population of Richland and North Richland.

CENTRAL PLANT with capacity of 200,000 lb per hour replaces 21 temporary boilers and furnishes steam to all buildings in North Richland. A similar plant in Richland furnishes central heat to administrative, commercial, dormitory and several school areas.



BARRACKS BUILDING takes one-mile voyage across Columbia River on barge, part of 15-mile trip from Pasco Naval Base to North Richland construction camp. In addition to river trip, two-story 30 × 80-ft barracks had to be transported 10 miles to river bank on special dollies and 4 miles on other side of river to final location.

mum 6.45 mgd), designed by DeWitt C. Griffin and Associates, is now nearing completion. This plant, in conjunction with the existing works, will treat the combined flow from the village and construction camp. After abandonment of the camp, capacity will be available for further growth of the village. The equipment employed is among the largest for a biofiltration process. The primary and secondary clarifiers are 115 ft in diameter, each with an overflow rate of 770 gal per sq ft per day, and the bio-filter is 152 ft in diameter with a dosing rate of 27.5 mgd.

Although two main railroads pass near the Hanford Works, connections to them pose difficult terrain problems. At present, the only railroad which gives access to the reservation traverses a narrow gorge and thence follows the Columbia River bank to the most remote plant area. All material destined for North Richland and Richland is hauled approximately 35 miles over the project railroad. Now in the final design stage is an additional railroad connection to the south of Richland which also must cross difficult terrain. The 3 miles of trackage involves a 500-ft truss at the Yakima River, two highway overcrossings, and an irrigation-ditch crossing. Approximately 5,000 ft of track will be laid on a fill averaging 16 to 38 ft in height.

Main-line diesel locomotives will operate trains to the classification yard near North Richland, where project crews will make up new trains. All equipment and approximately 125 miles of trackage within the reservation are operated and maintained by project personnel and a subcontractor. Construction of the railroad system, which was laid during the war, necessitated the use of considerable quantities of salvaged rail and ties. Replacement of light rails and deteriorated ties, together with added ballast and other improvements, has resulted in a track and roadbed suitable for the operation of 120-ton diesel locomotives.

Highway access to Richland is across the Yakima River. At the start of the present construction program, in the summer of 1947, it was necessary for many workers to seek temporary residence in the neighboring towns of Pasco and Kennewick. Over 13,000 vehicles were traveling the access road daily, and serious delays resulted during the morning and evening rush periods. To relieve the congestion, a timber trestle designed for H-20 loading was constructed expeditiously across the Yakima River alongside an existing steel truss. The access road was increased to four lanes. At the same time a bypass highway was constructed to the west of Richland to relieve the town streets of traffic bound for North Richland.

Dike Holds Off Second Largest Flood

The Columbia River, whose upper watershed is in the mountains of lower Canada and northern Washington, rises to a peak in June of each year. In 1948 a late spring, combined with sudden thaws and warm rains, released flood waters on the Columbia second only to the 1894 flood, the largest on record. Simultaneous high stages on the Yakima and Snake Rivers below Richland put the town in jeopardy. Emergency construction of temporary dikes was made possible only by diverting all earth-moving equipment and contractor personnel from normal construction to this task.

The main dike, approximately 5,800 ft long, became known as the "Miracle Mile." In three days, by working around the clock, crews hauled and placed approximately 64,000 cu yd of material in a dike between the river and business and housing areas. Flood waters were thus prevented from entering buildings and isolating vital sections of the village. A second dike was thrown around the sewage treatment plant, necessitating the pumping of the effluent by a battery of gasoline-operated pumps. Both dikes were constantly patrolled to observe any seepage. Raising and widening became necessary and sandbags were placed on the river side. Numerous jetties projecting into the river reduced the velocity of the flood waters.

Every effort was made to keep the main access road above the rising flood waters. An estimated 40,000 cu yd of material was placed on the 6,000 ft of roadway. The emergency construction kept in advance of the rising water until finally the flood won and the road became inundated. During the four weeks that the workers were forced to drive an extra 30 miles, absenteeism was surprisingly low.

Light planes operating from the Civil Air Patrol airfield commuted an estimated 200 passengers daily during the flood. After recession of the flood, the roadway was leveled off and paved with asphalt.

In February of this year, during unseasonably cold weather, an ice jam extending three miles above the timber highway trestle threatened to destroy this structure and also endangered the steel truss immediately downstream. The removal of 135 ft of the trestle saved the remainder of the structure. It is planned to bridge with Bailey units the gap in the two-lane crossing.

Richland will come within the reaches of the McNary Dam reservoir, now under construction by the Corps of Engineers. Permanent flood walls and levees, to be completed by early 1950, will protect the village, the Civil Air Patrol airport and the sewage treatment plant from normal backwater and from future floods on the Columbia. However, the temporary dikes have been left in place to guard against possible high water in June of this year.

Master Plan Developed for Area

In 1948, a Master Plan was developed jointly by J. Gordon Turnbull, Inc., and Graham, Anderson, Probst and White, Inc. Based on a study and evaluation of social, economic and physical aspects of the village, the plan presents an over-all scheme of improvements to traffic arteries, more efficient and economical land use, extension of the school system and other facilities, location of additional commercial and service areas, and extension of utility and transportation systems.

The principal streets in the original town follow the old county roads which, in general, were located on half-section and section lines. Since the main access route to Richland enters the village at the southeast corner, the north-south thoroughfares will require considerable widening and improvement. George Washington Way, the most direct route to North Richland, has been widened to 56 ft to accommodate four traffic lanes and two parking lanes.

RICHLAND'S DOWNTOWN AREA (above) includes community center in center foreground and markets on other side of main street, George Washington Way, which has been widened to 56 ft.

The school system, until recently, operated on a curriculum of eight elementary and four high school grades. In 1948, the adoption of six elementary, three junior high and three high school grades reduced the load on elementary schools and the high school, but required the construction of a new junior high school. With completion last year of a new grade school and additions to the existing four, there are available 85 general classrooms, eight kindergarten rooms and 15 special-purpose rooms. The new junior high school has 13 classrooms and nine special-purpose rooms. A modern gymnasium, shops and special classrooms have been added to the high school.

The school gymnasiums and auditoriums, as well as many classrooms, are the periodic meeting places of many organizations. In addition to 23 active religious groups, there are 17 recreational organizations, 20 social organizations, five music clubs, seven professional and educational groups, five political organizations, four veterans' organizations and eight welfare groups.

Only four church buildings are available at present. However, 20 sites for future churches have been selected and many congregations are now proceeding to build on land leased from the Government on a long-term basis.

Youth activities center around the Recreation Hall and the various schools and churches. It is proposed eventually to provide facilities for school groups, Boy and Girl Scouts and other similar organizations in one building or group of buildings.

Normal Community Activities Flourish

In many ways the village is becoming a normal community. Churches and fraternal organizations are applying for land on which to construct buildings. Private businesses are constructing stores, theaters and garages in the commercial and light-industry areas. Richlanders are contributing time and money toward many village-wide projects. Among these are a modern outdoor swimming pool now under construction and a golf course which is in the planning stage. The McNary Dam pool will provide recreational use of the Columbia River and will encourage the formation of one or more boat clubs.

In charge of all activities for the Atomic Energy Commission is Fred C. Schlemmer, M. ASCE, whose title is Manager, Hanford Operations Office. Second in command is David F. Shaw, Deputy Manager. Among the Manager's assistants are several Corporate Members of ASCE—James E. Travis, Assistant Manager, who is president of the Spokane Section's Columbia Branch, and William P. Cornelius, Chief, Construction and Maintenance Division, who supervises all new construction and plant and village maintenance. The Atomic Energy Commission's prime contractor, General Electric Co., is directed by George R. Prout, vice-president. Manager of the Richland Community Divisions is Earle L. Richmond. Principal subcontractors are Guy F. Atkinson-J. A. Jones (joint venture), J. A. Terteling and Sons, Morrison-Knudsen Co., L. G. McNeil Co., and C. C. Moore & Co.

REINFORCED CONCRETE BOX CULVERT 5×6 ft carries drainage flow through new Central Commercial Area of Richland and provides for surface and subsurface drainage of area itself. Commercial buildings in this section are financed by private capital and constructed on land leased from Government on long-term basis.

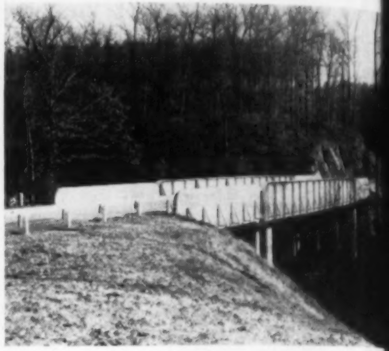
Residents of Richland recently elected their first town council to represent them to management. With the increase of private businesses and enterprises the townspeople are settling down to a normal life in a model town of 25,000 population where everyone takes an interest and pride in beautifying his yard and an active part in the many social and cultural opportunities that are available.

Navy Spends $40 Million on Research Facilities

DANIEL P. HIGGINS
Eggers and Higgins, Architects, New York, N.Y.

TWELVE MILES from the White House in Washington, D.C., on a 938-acre site, at White Oak, Md., 2,500 persons are at work in the 69-building Naval Ordnance Laboratory, recently dedicated, which cost $40,000,000. Within these structures, all directly associated with some phase of research and development of ordnance weapons and devices, are some of the world's finest facilities for scientific and engineering research. NOL is more than a "war project;" it is planned as a great laboratory for scientific research in a multitude of fields, both industrial and governmental. The unusual materials, methods of construction, and testing equipment that went into this unique laboratory are described by Mr. Higgins, whose firm was engaged by the Bureau of Yards and Docks to plan and supervise the work.

NAVAL ORDNA
LABORATOR



BRIDGE OVER PAINT BRANCH leads to explosives area, removed from rest of buildings in 938-acre area occupied by Naval Ordnance Laboratory, White Oak, Md.

MINES, WHICH PLAY an important role in harbor defenses and often in naval offensive plans, were, at the beginning of World War II, the Naval Ordnance Laboratory's field of endeavor. Located at the Naval Gun Factory in Washington, D.C., the Naval Ordnance Laboratory, known as NOL, was driving day and night to perfect Navy weapons. Project was added to project as new requests flowed across desks and into the shops and laboratories. Finally the inelastic walls of the factory yard could absorb no more of NOL's growth.

In 1944 NOL proposed, and the Navy's Bureau of Ordnance approved, the building of a modern, well-equipped "science campus" to facilitate further research. Funds were made available, the site was selected, and the Bureau of Yards and Docks engaged the writer's firm to work with the Laboratory and the Civil Engineer Corps in the preparation of plans and specifications. Construction began early in 1945. From this beginning, and through the collaboration of civilian and military leaders, the laboratory has developed into the comprehensive research and testing organization it is today.

Heart of the Bureau of Ordnance installation at White Oak is the main administration and laboratory building, construction of which was started late in 1946. It comprises five separate structures, which appear as one: an administration building, ammunition building, mechanical-test building, shop building, and an acoustically perfect auditorium for 550 persons, all connected underground by pedestrian passages.

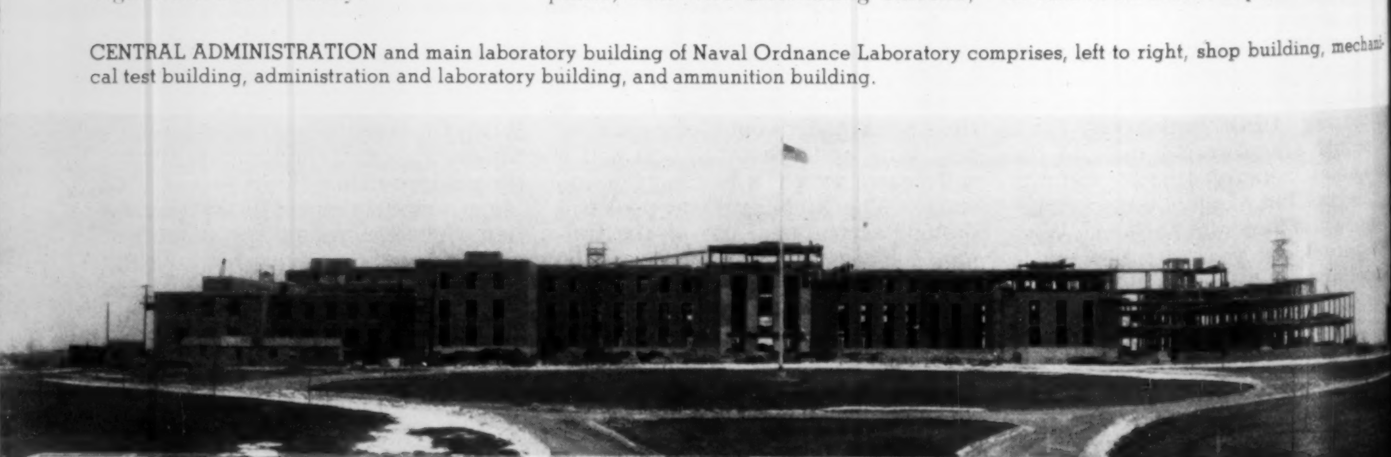
The buildings include an anechoic or "dead" room in which sound is studied; a complete photographic laboratory for handling high-speed film used in tests; a cafeteria; a credit union; a bank; post office; and small shops. In the anechoic room almost no sound is reflected from the walls; it is trapped by 5-ft wedges of fiber glass which line the walls, ceiling and floor. Here acoustically sensitive fuses are tested.

To meet the changing needs for space in the main building group, movable steel partitions, prefabricated in sections, are designed to be placed at any 11-ft interval perpendicular to the steel corridor walls, which also are movable. Laboratory services such as 120/208-volt, three-phase, four-wire alternating current; 120/240-volt direct current; and pipes for hot water, cold water, compressed air, gas, steam and acid-waste all are in service shafts located every 22 ft along each side of the corridor, with convenience terminals.

All services connect through floor ducts to all equipment in the rooms, however the equipment may be arranged. The shafts, air ducts, and air-conditioning ducts are concealed. Fluorescent lighting provides the laboratories with 35 ft-candle intensity recommended for best working conditions. Indirect-type fixtures illuminate the offices.

The ammunition building is specially designed and constructed for the protection of personnel and delicate research instruments in case of accident. The flooring is spark-proof; the lighting fixtures and wiring are explosion-proof; and the solid interior walls are provided with steel blowout-type window frames so that in case of an inside explosion the blast

CENTRAL ADMINISTRATION and main laboratory building of Naval Ordnance Laboratory comprises, left to right, shop building, mechanical test building, administration and laboratory building, and ammunition building.



ll blow out the windows with little terior damage. Many of the glass ndow panes have been replaced th transparent plastic.

Underwater Conditions Simulated

In the mechanical-test building, o provided with movable steel rtitions, are several unusual facili-s for testing mines under simulated erating conditions of water and air essure, humidity and temperature. he facilities include a 105-ton hydro-atic-pressure tank with a 40-ton hy-aulically operated door, nearly long ough to accommodate a Japanese e-man submarine, and strong ough to exert a pressure of 2,000 i of either air or water on heavy dnance being tested in it. The rizontal cylinder is a little over 38 long, is just under 9 ft in diameter, d has walls averaging 5 in. in thick-ss. Manufactured by Babcock and ilcox Co., four individual cylindrical ctions were welded together, each eld being subjected to the latest sting techniques, including X-rays, insure its ability to sustain 2,000-si internal pressure.

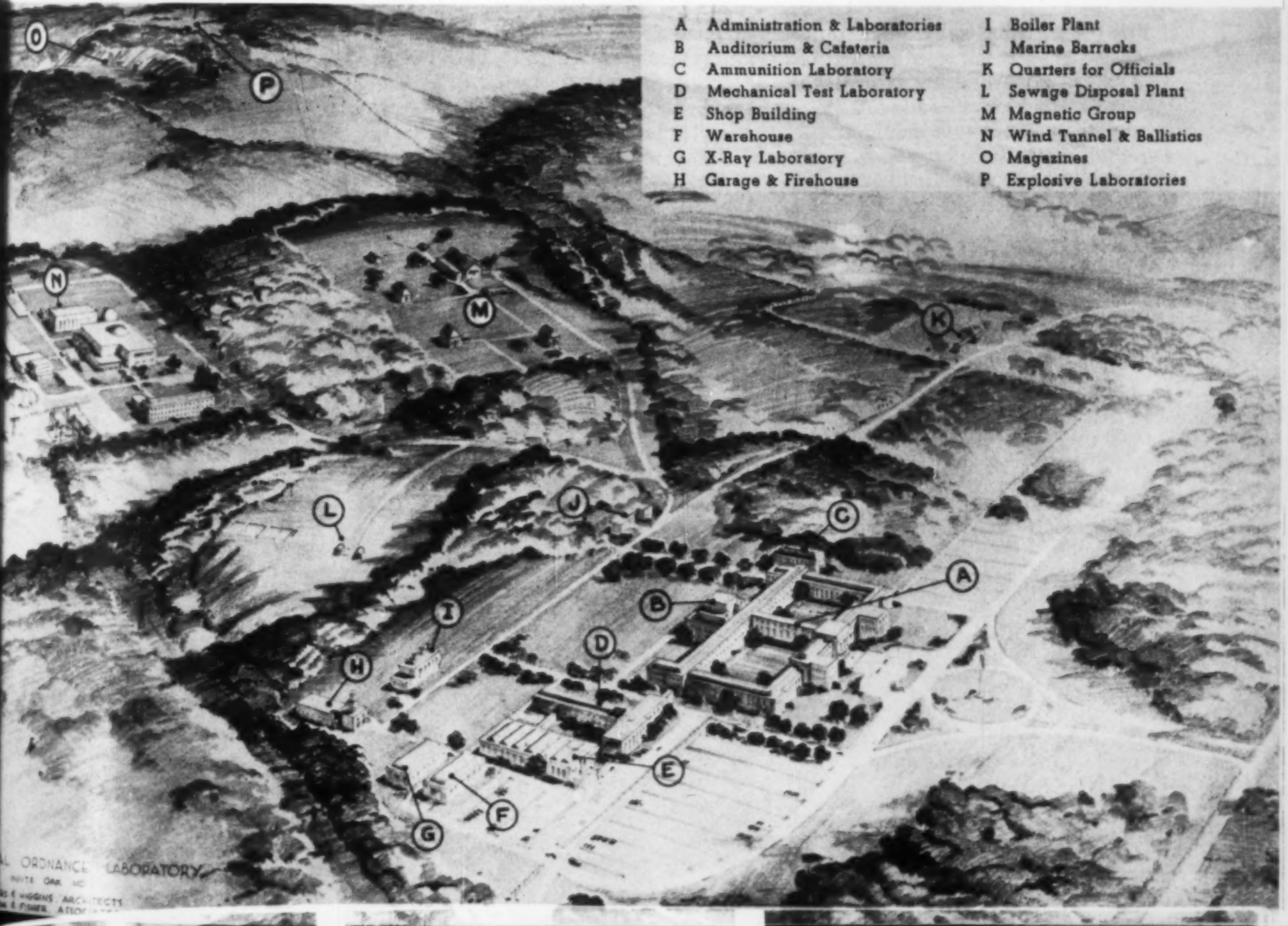
Transportation of the tank, an wkward heavy load, required a pecial flatcar for loading; a special "high-car" routing over the railroads; and a 25-mile speed limit because of clearance problems. Part of the three-week trip from the manufacturer's plant to the laboratory was taken up because of the railroad's requirement that the tank-bearing car be set on sidings to avoid passing other trains in either direction on the main tracks.

On arrival at the Silver Spring station on the Baltimore and Ohio Railroad, another three days were required to unload the big test tank onto a 40-wheel trailer, move it over a route carefully mapped by the Maryland Highway Commission to NOL, and unload it by means of specially rigged hoists and cranes onto its permanent foundations in the mechanical test building.

The mechanical test building also includes two temperature rooms, 8 by 8 by 15 ft, insulated with 12-in. of cork, within which temperatures can be varied from −100 to +180 deg F, with controlled humidity. Just outside of these rooms is a large sea-water tank, equipped with automatic controls to maintain the water at any desired temperature from +30 to +100 deg F. With quick access to the tank, test engineers can transfer ordnance from the temperature rooms to the salt-water tank to simulate any atmospheric and sea-water condition anywhere in the world. Refrigeration is by circulation of methylene chloride brine in cooling coils. The refrigerating machinery comprises 20 electric-motor-driven units totaling 600 hp.

CONTRACTORS' PLANT is located close to shop building and garage (left), fire station and boiler plant group (far right) for NOL.

U.S. NAVAL ORDNANCE laboratory consists of 69 buildings on tract at White Oak, Md., 12 miles from the White House.


A Administration & Laboratories
B Auditorium & Cafeteria
C Ammunition Laboratory
D Mechanical Test Laboratory
E Shop Building
F Warehouse
G X-Ray Laboratory
H Garage & Firehouse
I Boiler Plant
J Marine Barracks
K Quarters for Officials
L Sewage Disposal Plant
M Magnetic Group
N Wind Tunnel & Ballistics
O Magazines
P Explosive Laboratories
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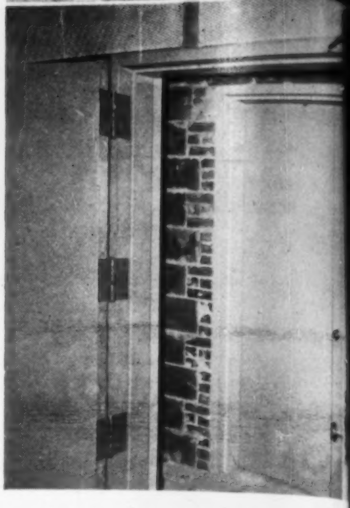
L ORDNANCE LABORATORY

A TYPICAL FEATURE of main laboratory buildings is steel movable partitions, above. All materials used in buildings in magnetic group, one of which appears at left, are non-magnetic and non-ferrous. Seven units of wind tunnel building are separated to avoid transmission of sound and vibration, as seen at right. Walking from one building to another is like passing from one passenger car to another on a train.



Satellite groups of buildings for special purposes are isolated from each other and from the main building in the 938-acre tract. One of these is the seven-building group for the study of terrestrial magnetism and the effect of magnetism on ordnance and actuators. Here Navy mines and equipment are tested with magnetometers highly sensitive to man-made magnetic influences. To reduce outside disturbances, the buildings are constructed exclusively of non-ferrous, non-magnetic materials with special precautions taken during construction. Sand and aggregate for concrete were used only after tests with sensitive magnetometers by laboratory scientists had proved that they contained no magnetic material. In a few places where reinforcing was necessary, brass rods were substituted.

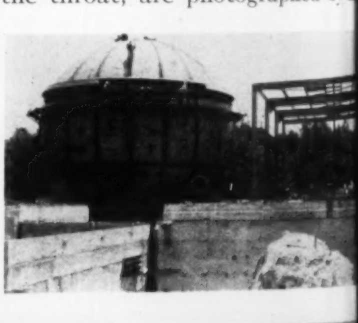
For the bearing walls of the buildings, red-clay brick containing iron oxide were discarded in favor of hollow concrete blocks made of tested aggregate. Wooden window frames were installed with bronze or brass hardware, and with lead counterweights suspended on bronze chains. Roof trusses of wood, fastened with copper nails, bronze gusset plates and bolts, rest on brass bearing plates on the walls. Roofs are shingled with slate; eave troughs are downspouts are copper; plumbing fixtures are brass; and drain pipes are of asbestos cement. Water and heating pipes as well as radiators are copper, and electric fixtures are aluminum, brass and plastic. All manhole covers are wood with reinforced concrete frames.

One of the non-magnetic buildings, being one of the first structures to be finished, was used temporarily as an office. When it was released for installation of test equipment, scientists testing the area found the wood-block floor reacting positively. The flooring harbored so many paper clips and bobby pins that it was ripped up and replaced.

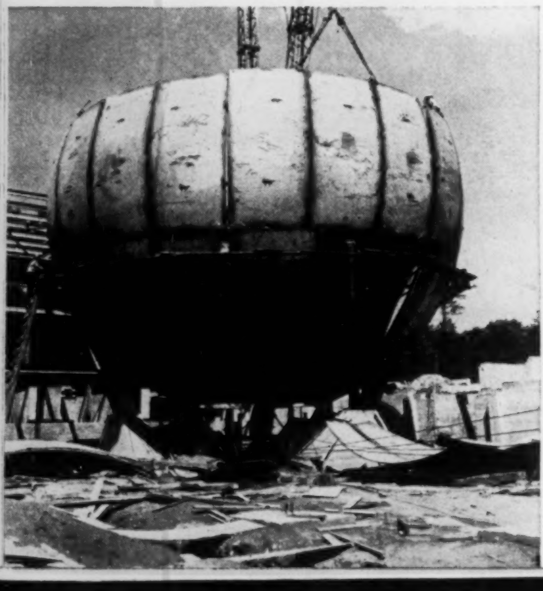
Structural frames supporting the magnetic coils representing terrestrial magnetic fields are built up of chemically impregnated and compressed-wood members, held together with gusset plates of the same material fastened with bronze screws and bolts.

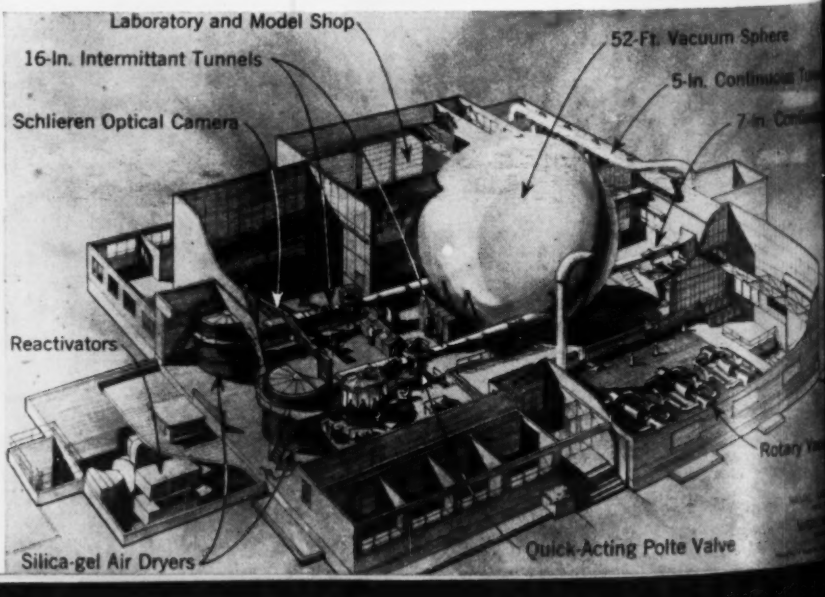
Another satellite building houses the supersonic wind-tunnel equipment, which advancing Americ troops captured from the Germans Kochel, Bavaria in 1945. It h been used to develop the German V rocket bomb. Air speeds 5.18 tim the speed of sound (Mach 5.18) a produced in a 16-in. square worki throat by a vacuum system. Tw this speed is expected as the equi ment is developed further.

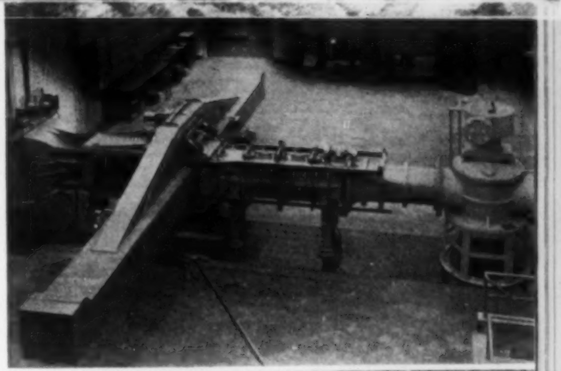
In operation, the 52-ft-dia welde steel sphere is evacuated to a fe millimeters of mercury by a batte of three pairs of German-made Dem rotary vacuum pumps, each pa driven by a 360-hp motor operating 4,000 volts each pump displaci 4,400 cfm. A quick-acting Pol valve is opened and atmospheric a is drawn rapidly through silica-g driers, increasing in velocity to supe sonic speed through the test-throat the tunnel. The shock waves in th air, produced as the air rushes pa scale models of projectiles placed i the throat, are photographed by a

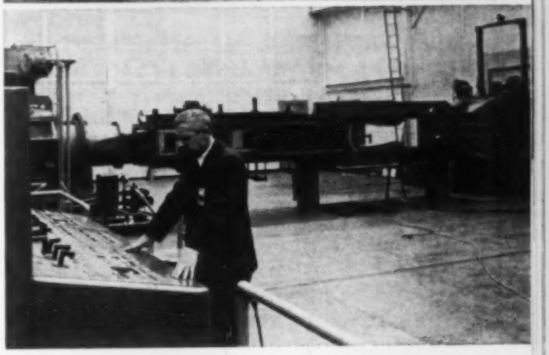


CAPTURED IN 1945 in Bavaria, Germany, 38 carloads of supersonic wind-tunnel equipment used to develop German V-2 rockets go to work for Navy at NOL. Air drawn through tunnel throat into 52-ft vacuum sphere at Mach 5.18 speed (5.18 times that of sound) tests action of projectiles in flight. All-welded steel sphere weighing 130 tons and constructed of 1.06-in. plates, erected by Chicago Bridge and Iron Co., operates 16-in. test tunnel.









VACUUM SPHERE can be evacuated in 10 minutes by battery of six rotary vacuum pumps (left). Building which houses sphere (above) is constructed with cork beds between footings and sound traps between sections to avoid transmission of vibrations and noise. Quick-opening valve allows air to rush through working section of 16-in. tunnel (at right, above) into sphere. Schlieren optical equipment photographs shock waves in air rushing past stationary projectile model. At lower right appears control panel and opened throat of 16-in. tunnel.

paratus known as the Schlieren ical system; and scientists take asurements of aerodynamic pres- res acting on the model by reading rcury manometers during the 40- duration of the test. After ten nutes, required to evacuate the here again, the tunnel is ready for other test. The plant has two in- mittent 16-in.-square wind tunnels d five 7-in.-square continuous tun- ls.

The wind-tunnel building appears ternally to be a single structure, but designed as seven buildings each parate from the others. One houses e vacuum pumps; another, the acuum spheres; the third the work- g section of the two 16-in. tunnels; other, four 5-in. basic research tun- ls; another, a 7-in. continuous nnel; another, a shop and labora- ry; and the seventh, the adminis- ative offices. The site for the build- g was chosen after test borings re- ealed a 6-ft cushion of earth above e rock which reduces transmission vibrations (resulting from the eration of the tunnels) through the ck strata to other buildings of the oup. Cork layers between the undations on which the buildings st further damp the vibrations used by the rush of air into the here. The considerable noise which companies the passage of air rough the tunnels is isolated by und traps between the parts of the ilding so that researchers can work th minimum difficulty during tests.

The cold-troweled mastic floor of the wind-tunnel test room is laid without joints or cracks to prevent accumulations of mercury frequently lost from pressure-measuring manometers. Mercury vapor appeared to have had a deleterious pathological effect on scientists working at the original installation at Peenemunde, Germany.

After model projectiles are tested in the supersonic wind tunnel, they are checked for action in flight in the range building. Capable of handling projectiles up to 1.6 in., one 350-ft range tests them in free flight and another pressurized range tests them under any pressure up to six atmospheres. Action of the missiles in flight is recorded by a battery of 50 spark cameras stationed at intervals along the range.

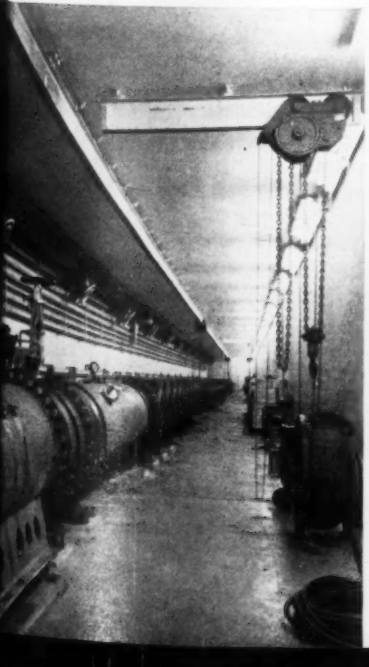
Ten-Million-Volt X-Ray Machine Installed

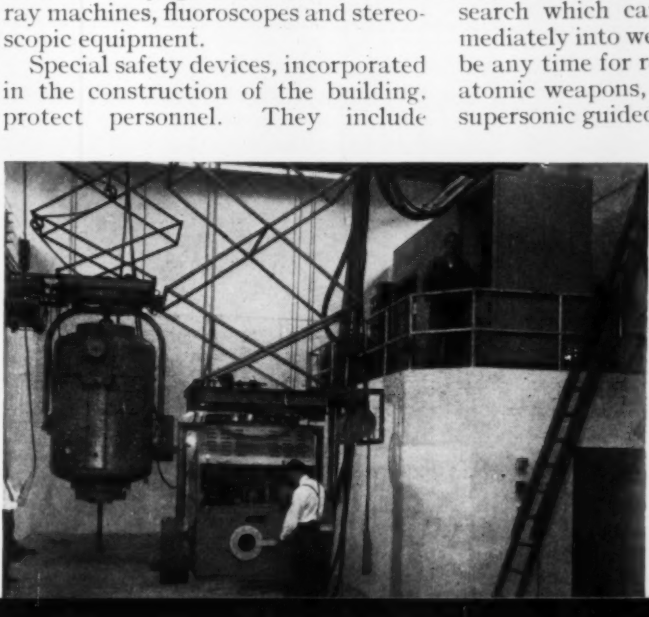
One of the highly useful installations at NOL is the X-ray laboratory which houses the world's first mobile 10-million electron volt betatron, capable of producing X-rays to penetrate 16 in. of steel. This machine, a small version of the 100-million electron volt atom smasher, is used in the radiography of castings and welds of naval guns and other ordnance equipment for detection of internal flaws. Other facilities in this laboratory include a 2-million-volt resonance transformer X-ray generator, smaller X-ray machines, fluoroscopes and stereoscopic equipment.

Special safety devices, incorporated in the construction of the building, protect personnel. They include extra-thick concrete walls, lead doors, audible alarm signals and automatic cutoff devices to stop operation of high-voltage instruments if persons should enter dangerous areas unwittingly.

The Naval Ordnance Laboratory was built by the Bureau of Yards and Docks for the Bureau of Ordnance. Harwood-Nebel Construction Co., Charles H. Tompkins Co., Dyker Building Co., Inc., and F. H. Mortell Co., Inc., all of Washington, D.C., had prime contracts on the construction of the 69 buildings and other facilities of the laboratory. Taylor and Fisher, of Baltimore, were associated with Eggers and Higgins. The architects enjoyed the advantage of close guidance, collaboration and assistance from all Navy personnel connected with the job, and especially the leadership of Rear Admiral Frank E. Beatty, Commander of NOL.

"In the next war—which we hope will never come—there can be no delayed action," Admiral Beatty has said. "We hope to have completed a large backlog of pure and applied research which can be translated immediately into weapons. There won't be any time for research in a world of atomic weapons, proximity fuses and supersonic guided missiles."





WIND TUNNEL results are checked on projectiles up to 1.6 in. both in free flight and in pressurized range, far left. Performance is recorded by 50 spark cameras. Left, 10-million-volt X-ray machine detects internal flaws in 16 inches of steel.

IN WIDESPREAD MALADJUSTMENT of highways and their traffic, size and weight of vehicles are dominant factors. Multiple-axle load distribution is favorable to preservation of highways and also to efficient vehicle operation. AASHO recommendations limit axle load to 18,000 lb.

Sizes and Weights of Motor Vehicles Require Economic Study

Presented Before the Highway Division, at ASCE's Oklahoma City Meeting

HERBERT S. FAIRBANK

Deputy Commissioner, Public Roads Administration, Washington, D.C.

IT HAS BEEN SAID that there would be no problem in the size and weight of motor vehicles if in highway transportation, as in railway transportation, the roadways were built and the rolling stock operated under the same management. The problem of the size and weight of vehicles *does* occur in practically identical form in both rail and highway transportation. The difference is that in railway transportation the single management responsible for both roadway and rolling stock has found a workable solution; in highway transportation a hydra-headed division of responsibility has thus far prevented a reasonable solution.

Forty-eight states and a federal district contain the highways, but in each there is a legislature, a highway department, a motor vehicle administration, a police department, and numerous counties and municipalities—all with a hand and a voice determining in some degree how the highways are built and what rules are prescribed or applied for their use.

Varied Agencies and Groups Use Highways

Among the users there are truckers, themselves a class divided, bus operators, farmers, industrialists, business men, and a large group of passenger automobile owners, each with a particular and variant view of the kind of roads that should be provided and how they should be used.

As a result of the complex interrelationships among these varied agencies and groups, whose purposes and desires change with both time and place, our highway system answers to no clear rule of intended usage. This highway system is used by a traffic that should, but does not, conform to a variety of unenforced controls, many of which have been devised with no sufficient regard for the character and condition, the capacities and weaknesses of the highway system.

In the widespread maladjustment of the highways and their traffic there are few conditions of faulty relationship in which the size and weight of vehicles are not in some degree involved. Whether the road-traffic relationship is good or bad is determined generally by the largest and heaviest vehicles.

The problem has two aspects—from the viewpoint of the capacities and strengths of the existing highway plant, and from the viewpoint of the capacities and strengths that should be provided in newly constructed highways. Much of the discord that surrounds the problem emanates from failure to recognize these dual aspects.

AASHO RECOMMENDATIONS FOR MAXIMUM MOTOR VEHICLE SIZES AND WEIGHTS

The AASHO Policy recommends for uniform adoption in the laws of all states the following limitations on motor vehicle sizes and weights:

Maximum width of vehicle	**96 in.**
Maximum height of vehicle	**12 ft 6 in.**
Maximum length of vehicle:	
Single trucks	**35 ft**
Single busses (with 2 axles)	**35 ft**
Single busses with not less than 3 axles) . .	**40 ft**
Truck-tractor and semi-trailer combinations .	**50 ft**
Other combinations (not more than 2 units) . .	**60 ft**
Maximum loads on vehicles:	
Single axles	**18,000 lb**
Groups of axles—tabulated loads varying with distance between extreme axles of any group, measured to nearest foot, ranging from 32,000 lb for axles spaced 7 ft or less apart, to 73,280 lb for all axles within a distance of 57 ft.	**32,000 lb to 73,280 lb**

From one viewpoint, the conditions controlling a reasonable solution of the problem are the strength and capacity of existing roads and bridges. From the other viewpoint the controlling condition should be the maximum limits of size and weight of vehicles within which highway transportation may be expected to achieve an optimum economy, considering both road and vehicle costs. A solution reached from the latter viewpoint envisaging the economy of highway transportation alone, might require some revision if highway transportation is viewed as a part of the entire transportation system, embracing rail, water and air as well as highway facilities.

Controlling Conditions Under Study

Amid a confusion of claims and counter claims which ignore the differences between these two aspects of the problem, two efforts have been and are being made to reach acceptable conclusions from the two points of view, clearly distinguished.

One of these was the effort of the Highway Transport Committee of the American Association of State Highway Officials which resulted in 1946 in the adoption by the association of a "Policy Concerning Maximum Dimensions, Weights and Speeds of Motor Vehicles to be Operated Over the Highways of the United States." This effort approached the problem from the viewpoint of the strength and capacity of existing roads and bridges.

The other is the investigation now being pursued by the Committee on the Economics of Motor Vehicle Size and Weight of the Highway Research Board. This effort is attacking the problem from the viewpoint of possible eventual achievement of a highway transportation system of optimum economy.

The objective of both efforts has been, and is, to define the maximum

LOAD LIMITATIONS ARE ESSENTIAL to protect existing roads and bridges and to make possible adequate design of future highways. Small trucks are more numerous, but large combinations are more critical, in highway design.

sizes and weights of vehicles that are consistent with the two controlling conditions. In respect to one—the effort of the American Association of State Highway Officials—it is possible to discuss conclusions reached, as enunciated in the published Policy. In respect to the other—the effort of the Highway Research Board—discussion must be limited to a consideration of purposes; conclusions must await the completion of an extended investigation, still in its earlier phases.

The AASHO limits, tabulated on this page, were not decided without due consideration. There is a good reason for every one of them separately, and together they form a system of limits coordinated according to calculated and appropriate relationships. A change in certain of the limits without a corresponding change in others would adversely affect these relationships.

Three considerations, in the order named, were paramount in the determination of these limits:

1. Prevailing strength and capacity of existing roads and bridges to support and accommodate traffic, including vehicles of the indicated maximum sizes and weights, in substantial frequency.

2. Provision of a scope within which vehicle design and operating practice can be adjusted to the necessities of efficient haulage.

3. Provision of a system of limits having a reasonable prospect of uniform adoption in the laws of all or a majority of the states.

Anticipating the possibility that future transport necessity and proved economy may justify the employment of vehicles larger and heavier than those provided for within the present limits, certain of these limits may in time be appropriately revised upward while others remain permanently fixed. The alteration would be accomplished in such manner as to permit the most practicable adjustment of the road system to the needs of the enlarged vehicles.

Height and Axle Load Fixed

The limits that are intended to remain permanently fixed are the height limit of 12 ft 6 in. and the axle-load limit of 18,000 lb. From the viewpoint of the capacity of the existing road system, any upward change in these limits would have vastly disturbing effects. A large mileage of road surfaces and foundations would require strengthening if the axle-load limit were raised; many existing vertical clearances would require alteration, and the difficulty of providing clearance at many grade-separating structures yet to be built, particularly in cities, would be greatly increased if the height limit were raised. From the viewpoint of transportation need, these two limits can remain fixed with least restriction on a rational enlargement of highway vehicles. Greater load can be carried in the presence of the fixed axle-load limit by multiplying axles. Pay loads requiring vehicle height in excess of $12^1/_2$ ft are, and will probably remain, of such rarity as to be more appropriately accommodated as exceptional movements, routed to avoid limiting bridge clearances.

In contrast with these limits, which should be regarded as permanently fixed, are the limits of width, length and group-axle loading, which should be viewed as subject to possible increase in response to demonstrated need.

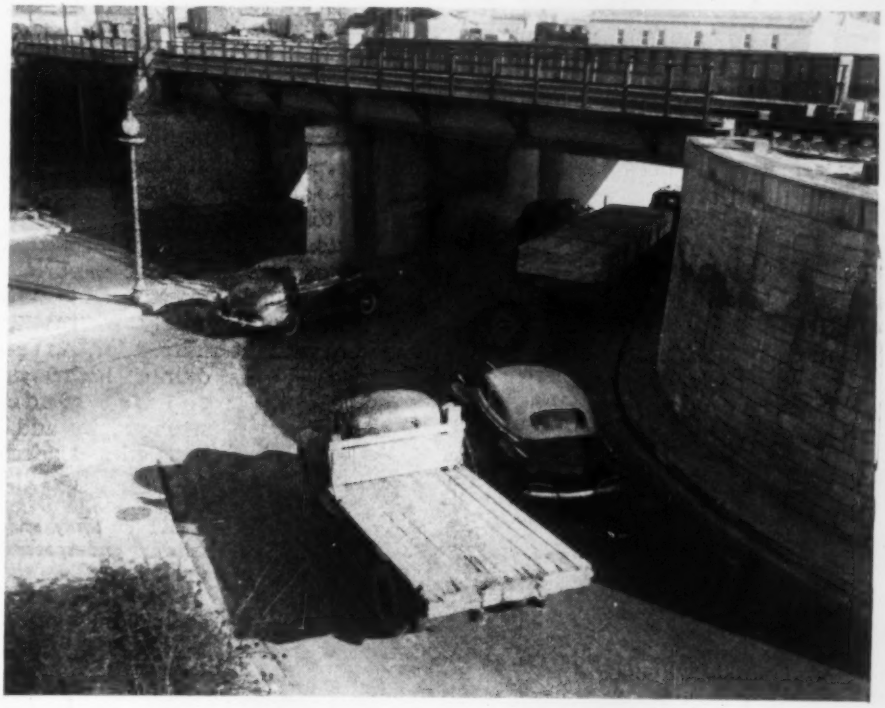
The 96-in. limit of width is generally essential now because of the large mileage still surfaced with pavements less than 20 ft wide. As rapidly as possible the lane width of road surfaces should be increased; and when this improvement has spread sufficiently, the vehicle width limit should be increased to 102 in. An advisory note attached to the AASHO recommendation suggests this future change. Well substantiated needs of vehicle design, particularly for brake efficiency in trucks and body convenience in busses, already point to the eventual necessity for changing the width limit.

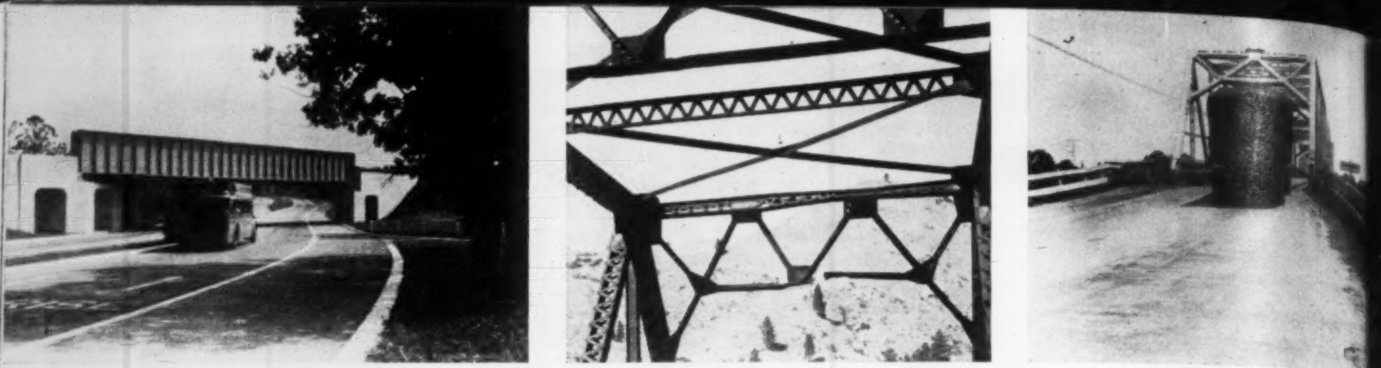
Truck Power, Not Length, Needs Control

In regard to vehicle length and group-axle limits, and the essential relation existing between them, there is the greatest potentiality for change consistent with future transport necessities.

The length limits, as recommended for the several classes of vehicles,

LIMITATIONS IMPOSED BY TURNING SPACE available at city street intersections will be last to yield to any demonstrated need for greater vehicle length. AASHO recommended length limit of 35 ft for single trucks determines measure of off-tracking of rear from front wheels on curves. Lengths of combination vehicles—50 ft for tractor-semitrailer and 60 ft for full trailer combination—are determined so as to give same demand for pavement width on curves.





COSTLY CONSTRUCTION FEATURE is provision for vertical clearance of maximum-height vehicles. In AASHO recommendatio vehicle height is limited to 12 ft 6 in. If this limit is raised many existing structures will require costly alteration, and difficulty of providi clearance at many grade separations yet to be built, particularly in cities, will be greatly increased. Center view shows damage to st structure at Horseshoe Bend, Idaho, due to log loads in excess of legal limit.

have in one respect a reasonable consistency. The 35-ft length of single trucks determines certain measures of off-tracking of the rear from the front wheels on curves. These measures are approximated by the similar off-tracking of tractor-semi-trailer combinations and full trailer combinations at the recommended lengths of 50 and 60 ft respectively. This rule of consistency, influencing the decision as to combination lengths so that these lengths will make the same demand as single trucks for pavement width on curves, will have less weight in the presence of the certainly wider pavements of the future. The road-width restriction removed, the greater off-tracking of longer trailer combinations will lose much of its force in determining reasonable vehicle lengths. The limitations imposed by the turning space available at city street intersections will be the last to yield to any demonstrated need of greater length.

Also the length limit cannot be extended without taking into account the greater difficulty that may be entailed in accomplishing the passing maneuver. Increasing the length of vehicles tends to increase the time required for other vehicles to pass them, and correspondingly to increase the length of the opposing traffic lane—on two-lane roads—occupied by the passing vehicle. It does not appear, however, that these consequences will be of much moment within the range of any probable extension of the combination-vehicle length.

Under conditions in which the vehicle length alone might be expected to affect the difficulty of passing, observations by the Public Roads Administration show, on the average, almost the same numbers of vehicles trailing, in the same time intervals, behind short as behind long vehicles, within the range of vehicle length available for observation. Results of observations of this sort on a section of level 20-ft pavement of unrestricted sight distance, near Bakersfield, Calif., indicate that within the range covered by the most liberal of present laws, vehicle length, per se, may have practically no effect on the difficulty of passing.

The longer queues that presumably are formed behind the longer vehicles on grades in the presence of a short sight distance are probably attributable to the weight rather than the length of the vehicles, and with more reason to the combined inadequacies of vehicle power and road sight distance. Appropriate vehicle power as a concomitant of vehicle size and weight is a condition that perfected law and practice of the future must assure; and short sight distance is a serious fault of existing highways which must and will be remedied whether vehicles are long or short, heavy or light.

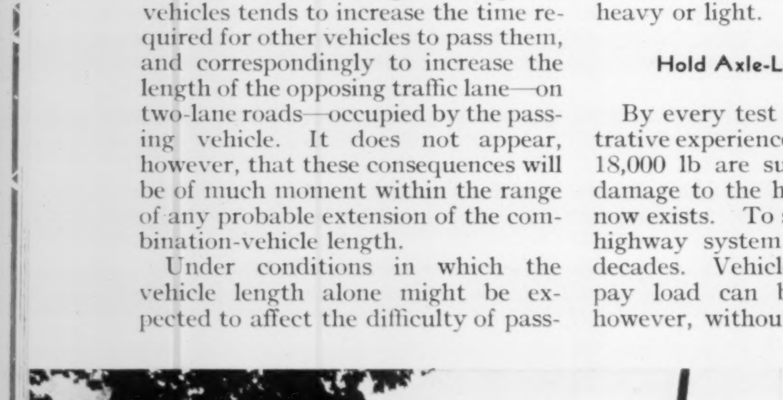
Hold Axle-Loads to 18,000 Lb

By every test of highway administrative experience, axle loadings above 18,000 lb are suspect as a cause of damage to the highway system as it now exists. To strengthen the entire highway system is a task requiring decades. Vehicle gross weight and pay load can be safely increased, however, without waiting for, or requiring highways to be made stronger, by adding axles loaded within the 18,000-lb limit. Addin axles requires space—vehicle length—in which to add them. The same ad dition of length that conservative distributes vehicle load to wheels contact with the highway also distributes the load in reasonable rela tion to desirable conditions of vehic design. And finally, the same addition of length and axles that is necessary to distribute loads borne by th highway and the vehicle is imperativ for the protection of existing bridges and in some measure is involved as a essential condition for the design o new bridges of any strength.

The group axle loads and corre sponding axle spacings recommended by the AASHO are predicated upo the safe working capacity of H-1 bridges. Bridges of this, the predominant existing design standard, will with equal safety support heavier vehicles of appropriately increased length and axle spacing. They wil support without failure, but with a reduced margin of safety, heavier vehicles of the same lengths and axle spacings. But only by the adoption of a stronger standard of bridge design can the factor of bridge safety contemplated in the Association's recommendations be preserved in the presence of heavier group axle loads within the same axle spacings and limits of length. Bridge design practice is now tending in this direction, as indicated by the increasing adoption of H-20 and H-20 S-16 design loadings for bridges on the federal-aid and state highway systems.

Tendency Toward Increased Vehicle Weigh

Vehicle weighings the country over show a presistent, indeed an increasing tendency toward heavier gross vehicle weight from year to year. Whether this tendency accords with a sound over-all economic policy for highway transportation remains to be determined, and is the objective of the studies in progress. Whatever the answer to this question may be, it might be possible, without further investigation, to conclude that the



MANY highway and railway underpasses would have to be reconstructed if limitation of 12 ft 6 in. on vehicle height were raised.

st expensive of three possible solu-ns to the problem presented by the dency toward heavier gross ve-le weight, all costs considered, uld be to distribute these heavier al weights in accordance with the le load and spacing limits recom-nded by the AASHO but within eater limits of length.

Next in point of expense would me the decision to follow the length well as the axle load and spacing commendations of the Association d provide for a general strengthen-g of bridges. The most expensive urse would be to encourage or per-it the heavier gross weights to be flected in heavier axle loads, damag-g to nearly all existing road sur-ces and requiring greater strength all surfaces to be constructed in the ture.

Unfortunately, it is precisely this ost expensive solution that is rmitted—rather encouraged—by any existing state regulatory laws d by many of the changes inad-sedly made in these laws from time time.

Any law that provides either no mit or a high limit on the axle load, the presence of gross weight limits related to vehicle length and axle ading and spacing, has this effect. A law limiting gross vehicle weight, in agnitudes defined only by classes of hicles, may have the same effect, en if it moderately limits axle loads.

Much of the tinkering that is done y legislatures from time to time, re-lting in changes of one or more mits of the regulatory law without rresponding appropriate changes in her limits, may have a like effect.

California and New Jersey Laws Compared

In California, where the law pre-ribes an axle-load limit of 18,000 b, a maximum gross vehicle weight of 76,800 lb, and a maximum length f 60 ft, the average gross weight of hicles in use is greater, as desired y vehicle operators, while the aver-ge number of axles is greater and the verage axle-load less, as desired by ad and bridge designers, than in ew Jersey where the law prescribes o limit on axle load, a maximum oss vehicle weight of 60,000 lb, and maximum length of 50 ft. The eaviest vehicles weighed in the two tates were of almost equal gross eight, above 90,000 lb. But among he axle loads in New Jersey were any above 30,000 and one above 0,000 lb, whereas in California, law-iolating axle loads were mostly nder 20,000 lb and none were over 0,000 lb. In New Jersey axle loads ver 20,000 lb were 8.6 percent of those weighed; in California 0.3 percent.

EXTENSION OF LENGTH limit of vehicles must take into account any greater difficulty that may be entailed in accomplishing passing maneuver. However, observations of Public Roads Administration appear to show that longer queues formed behind longer vehicles on grades are attributable to short sight distance combined with inadequate power of heavy vehicles rather than to length of such vehicles alone.

The California law closely approximates the recommendations of the American Association of State Highway Officials. The New Jersey law, undoubtedly the country's worst, is farthest in principle and in its specific provisions from the Association's proposals. A highly satisfactory vehicle operating practice is in actual effect in California. In New Jersey, vehicle operators insist that their business would be jeopardized by a change in the law requiring them to conform with what is the established California practice.

Pending the more exact evaluation of the fundamental economics of motor-vehicle size and weight now in progress, the AASHO recommendations constitute the best guide to an improved adjustment of state regulatory laws to the present requirements of vehicle operation and the necessities of a conservative highway policy. Laws made to conform to these recommendations have a basic design consistent with principles inherent in the economy of highway transportation. As more precise economic study points the way, they may be altered, probably liberalized, in some of their specific provisions.

Highway Research Board Studies Economics

The study now in progress under the auspices of the Highway Research Board enjoys the blessing of highway and automotive engineers, public highway authorities, vehicle manufacturers and both truck and bus operators.

In the first phase, completed last autumn, the direct operating costs of fuel and time were determined for vehicles ranging in gross weight from 20,000 to 140,000 lb. Highway experiments yet to be made by the Board in subsequent phases of the research are aimed at a determination of vehicle operating and road costs, determined for each size of vehicle, in such manner as to determine the vehicle weight or class corresponding to the lowest combined costs of vehicles and road per unit of gross weight and pay load moved.

HEAVY COMBINATION VEHICLE is used in study now being conducted by Committee on Economics of Motor Vehicle Size and Weight of Highway Research Board. First phase of investigation is study of vehicle operating cost as related to gross vehicle weight. Conclusions must await completion of extensive research program.

When present uncertainties affecting the size and weight of motor vehicles have been removed by the projected research, and not before, a guide to the sound regulation of vehicle sizes and weights will be available which is better than that now provided in the recommendations of the American Association of State Highway Officials. The new research, it is hoped, will provide a much needed guide to the determination of future road and bridge design standards.

Mile-Long Cofferdam Withstands 75-Ft Head in Chain of Rocks Project

Low Infiltration Rate Saves High Sheetpiling Costs

E. E. WHITE, M. ASCE

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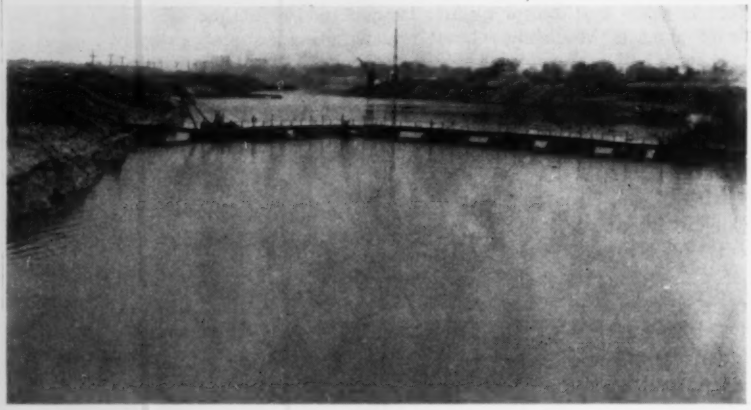
DREDGE DISCHARGE LINE (below) carries excavated material from cofferdam to build up embankment. Dredge entered cofferdam by digging access channel seen in background. Restrictive suction of 25 ft limited first cut of dredge and required lowering of water level 30 ft to permit dredge to reach bottom.



ESTIMATES OF a 100,000-gpm water infiltration forced contractors to start driving steel sheeting to rock around the 15-acre cofferdam near Granite City, Ill., for a Mississippi River lock. Actual infiltration proved to only 5,000 gpm, a fraction of the estimate, and the steel sheeting plan was abandoned after only 1,200 of the required 5,200 ft had been driven. The contractors were not so pleasantly surprised when a 6½-ft drop in the river in a 24-hour period caused 140,000 cu yd of cofferdam embankment to wash into the excavation. The deceptive hydraulics of this extremely large cofferdam are here related.

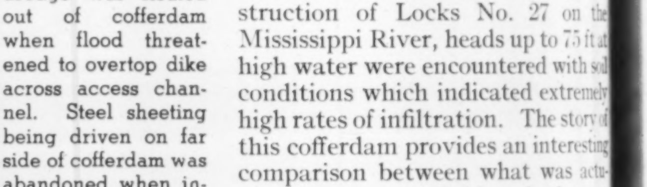
WATER LEVEL pumped down to 14 ft above bedrock (middle, left) permits dredge to complete work inside cofferdam. Later dredge was floated out of cofferdam when flood threatened to overtop dike across access channel. Steel sheeting being driven on far side of cofferdam was abandoned when infiltration proved to be only 5,000 gpm.

DEWATERED COFFERDAM (bottom, left) has flat side slopes, deeply eroded. Dark soil indicates seepage line.

WHAT PROMISED TO BE an unwatering job of a size almost without precedent never materialized for the River Construction Corp., thus saving high pumping and sheetpiling costs. In a cofferdam enclosing 15 acres, which was built for the construction of Locks No. 27 on the Mississippi River, heads up to 75 ft at high water were encountered with soil conditions which indicated extremely high rates of infiltration. The story of this cofferdam provides an interesting comparison between what was actually done in the field and what was originally planned from available borings and other data.

Locks No. 27 consist of two parallel structures 110 ft wide with the main lock 1,200 ft long and the auxiliary

FIG. 1. Locks No. 27 (below) form part of U.S. Corps of Engineers channelization project, which will bypass treacherous Chain of Rocks Rapids in Mississippi River.



COFFERDAM 5,200 FT LONG encloses construction area for Locks No. 27 of U.S. Corps of Engineers' Chain of Rocks Project. No sheet piling is used in 80-ft-high embankment. Rock toe stabilizes side slopes and provides excellent roadway, shown encircling area.

lock 600 ft long. These locks are part of the Chain of Rocks Project started by the U.S. Corps of Engineers in 1947 to bypass the hazardous Chain of Rocks Rapids on the Mississippi River just above St. Louis and below the confluence of the Mississippi and Missouri Rivers. (See article by R. E. Smyser, Jr., M. ASCE, CIVIL ENGINEERING for June 1947, p. 16.) The locks are 2,500 ft from the Mississippi River in an old backwater channel called the Cabaret Chute, which is 200 ft wide by 20 ft deep and runs through the center of the job (Fig. 1).

The twin concrete locks, containing about 400,000 cu yd of concrete, are founded on limestone 65 ft below the level of the flood plain. Excavation of an area approximately 1,750×375 ft at the bottom, involving the removal of approximately 1,700,000 cu yd of material, was required for construction (Fig. 2).

The main problem facing the contractors was the serious groundwater condition connected with unwatering the cofferdam. All signs pointed to a vast quantity of infiltration. Borings indicated layers of gravel and coarse sand overlying the rock. One boring showed as much as 22 ft of this material. As the head when pumping would be as much as 75 ft, it was assumed that these layers would carry large volumes of water. In substantiation of this assumption, at the time of the bid another contractor, pumping in a 40-ft-deep bridge foundation excavation in similar material about six miles away, had to pump 10,000 gpm from a relatively small area. The probability of a high rate of infiltration was further confirmed by the large industrial wells at Granite City two miles to the east, which supply 23 mgd.

In setting up the pumping plant, the experience at Lock No. 26, at Alton, Ill., 17 miles upstream, was used to estimate the quantity of water to be pumped. From the empirical formula, $Q = KHP$*, K at Alton was computed to be 0.25. As the job at Locks No. 27 did not have a rock bottom, a value of 0.10 was assumed for K there, giving an infiltration of 32,000 gpm at mean water level and 46,000 gpm at high water level. An additional check was made by engaging a prominent hydraulics consultant to investigate the pumping problem independently. He estimated the infiltration at 100,000 gpm.

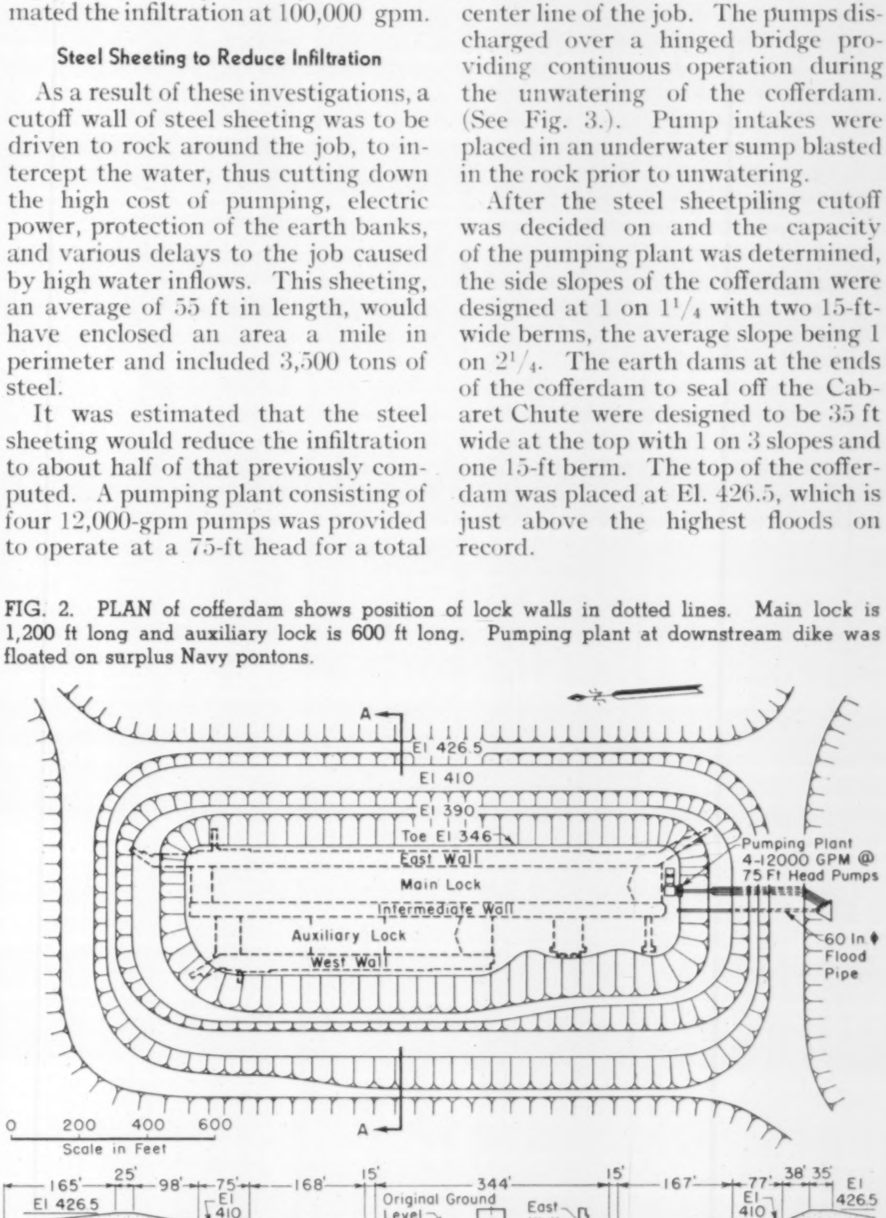
Steel Sheeting to Reduce Infiltration

As a result of these investigations, a cutoff wall of steel sheeting was to be driven to rock around the job, to intercept the water, thus cutting down the high cost of pumping, electric power, protection of the earth banks, and various delays to the job caused by high water inflows. This sheeting, an average of 55 ft in length, would have enclosed an area a mile in perimeter and included 3,500 tons of steel.

It was estimated that the steel sheeting would reduce the infiltration to about half of that previously computed. A pumping plant consisting of four 12,000-gpm pumps was provided to operate at a 75-ft head for a total capacity of 48,000 gpm. The pumps were concentrated on a single barge made up of surplus Navy pontons, located at the downstream dike on the center line of the job. The pumps discharged over a hinged bridge providing continuous operation during the unwatering of the cofferdam. (See Fig. 3.). Pump intakes were placed in an underwater sump blasted in the rock prior to unwatering.

After the steel sheetpiling cutoff was decided on and the capacity of the pumping plant was determined, the side slopes of the cofferdam were designed at 1 on $1^1/_4$ with two 15-ft-wide berms, the average slope being 1 on $2^1/_4$. The earth dams at the ends of the cofferdam to seal off the Cabaret Chute were designed to be 35 ft wide at the top with 1 on 3 slopes and one 15-ft berm. The top of the cofferdam was placed at El. 426.5, which is just above the highest floods on record.

FIG. 2. PLAN of cofferdam shows position of lock walls in dotted lines. Main lock is 1,200 ft long and auxiliary lock is 600 ft long. Pumping plant at downstream dike was floated on surplus Navy pontons.



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* Q = quantity of water to be pumped, in gpm; K = coefficient of pumping; P = perimeter of cofferdam, in ft.; H = head.

DRAGLINE WITH PERFORATED BUCKET (above, left) excavates trench for rock toe. Rock placement by bulldozer immediately follows excavation to prevent washing in of sand. Later material was removed from inside perimeter of rock trench and remainder of rock toe was placed to complete stabilization of side slopes. COFFERDAM SEEN SHORTLY AFTER DEWATERING (above, right) shows sharp contrast between right bank, stabilized by rock toe drain, and left bank for which toe drain has not yet been placed. Pumphouse resting on bottom in foreground floated on surface of water during dredging operations. Pipe 60 in. in diameter at left protects cofferdam from overtopping, and is capable of filling excavation in 60 hours.

To protect the cofferdam from overtopping due to a very unusual flood, failure of a dike, or other contingency, a 60-in.-dia flooding pipe was run through the downstream dike at El. 370. This pipe was designed to carry enough water at high flood stage to fill the cofferdam completely in 60 hours or to fill half of it in 15 hours. The intake of the flooding pipe consisted of a 60-in. gate riveted to the pipe, sheetpiling wing walls, and a 12-in. reinforced concrete slab at the entrance to the pipe. A second valve to be used in case the first valve was jammed was located in the earth dike. The pipe was placed horizontally through the earth embankment and on a trestle extending from the dike on the inside so that it would discharge on the rock floor, eliminating any possibility of scour of the earth dike.

The first step in the construction of the cofferdam was to bring in the 20-in. electric dredge *Calumet* to the downstream end of the job through the approach channel of the Cabaret Chute. This channel had been previously excavated by the Corps of Engineers to a point several hundred feet downstream from the site. The dredge cut its own access channel 150 ft wide into the lock area. As the water level was low, the dredge could not reach the top of the slopes, and material there was either taken out by dry-land operations or cast into the water to be removed by the dredge.

The depth of the first cut was limited by the dredge's 25-ft suction. To excavate to rock it was necessary to close the lock area with dikes at the upstream and downstream ends and pump the water down. As the rock was 65 ft below the flood plain, the water in the cofferdam had to be lowered 30 ft at mean water to permit the dredge to complete excavation.

Shortly after dredging started, driving of the steel sheeting began at the southeast side of the job, using a 9B3 McKiernan-Terry hammer. Even with air and water jets, driving was found to be very difficult. It was impossible in many cases to drive the sheeting nearer to the rock than 10 or 15 ft, which seriously affected the value of the cutoff.

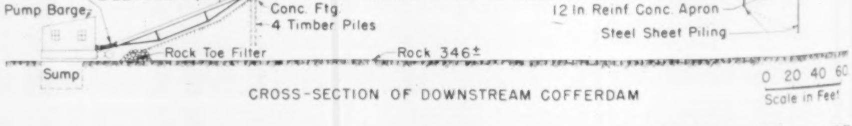
Infiltration Only 8,000 gpm

While the sheeting was being laboriously driven the dredge was making good progress, and had pumped the water level down to within 12 ft of the final grade. Tests of seepage made when the dredge was shut down indicated only about 8,000 gpm of infiltration. The banks drained to within several feet of the water level with little erosion, and test wells outside the cofferdam showed that the groundwater level had fallen on a rather flat curve. It was also observed that there was no relation between the infiltration and the river level. From this information it was apparent that the effect of the steel sheeting would be much less than originally anticipated, and with no regrets the driving of the sheeting was stopped. In two months of operation about 1,215 lin ft out of a total of 5,200 lin ft had been driven, with only 415 lin ft actually landed on rock. The rest of the sheeting was kept on the job for about eight months in case it might have to be used and was then disposed of.

About the time the driving was stopped, the U.S. Corps of Engineers predicted a sudden rise of the river likely to overtop the temporary downstream dike through which the dredge was to pass on completion of the excavation. As overtopping of the dike would damage the dredge, dewatering pump and other valuable equipment in the cofferdam, and as only clean-up dredging remained to be done, the excavation was flooded, the dredge floated out, the downstream dike completed to full height, and the water in the cofferdam pumped out. The time saved in this operation compensated for the extra cost of removing the remaining excavation by land methods.

While the dredge was raising the downstream dike prior to dewatering of the cofferdam, the flood crested at El. 408 and started to fall. The level continued to drop at the rate of about 0.8 ft per day for six days, and then fell at the astounding rate of $6^1/_2$ ft in 24 hours. The 60-in. sluice gate in the cofferdam was left open as the valves were designed for one-way head only, and the water in the cofferdam fell with the river. The rapid drop of the river left the water table perched in the sand and silt of the banks with the result that the next day slides occurred all around the sides of the cofferdam. Some of the slides left cliffs 20 ft high which had to be smoothed out by draglines.

FIG. 3. PUMP BARGE floats over sump at downstream embankment. After cofferdam was dewatered, pump barge was moved 100 ft into cofferdam to permit cleaning of sump. Settling basin, periodically excavated by truck-crane, kept sand out of sump.



CROSS-SECTION OF DOWNSTREAM COFFERDAM

Soundings later revealed that about 140,000 cu yd of material had slid into the bottom of the excavation.

In pumping out a cofferdam it has always been the practice to lower the water level slowly to permit the side slopes to drain, preventing slides of this type. However, this drop was so rapid and so unexpected that the damage had occurred before the situation was fully comprehended. This occurrence illustrates one of the dangers of a rapidly falling river and one that should be carefully guarded against, particularly in earth cofferdams built of fine material.

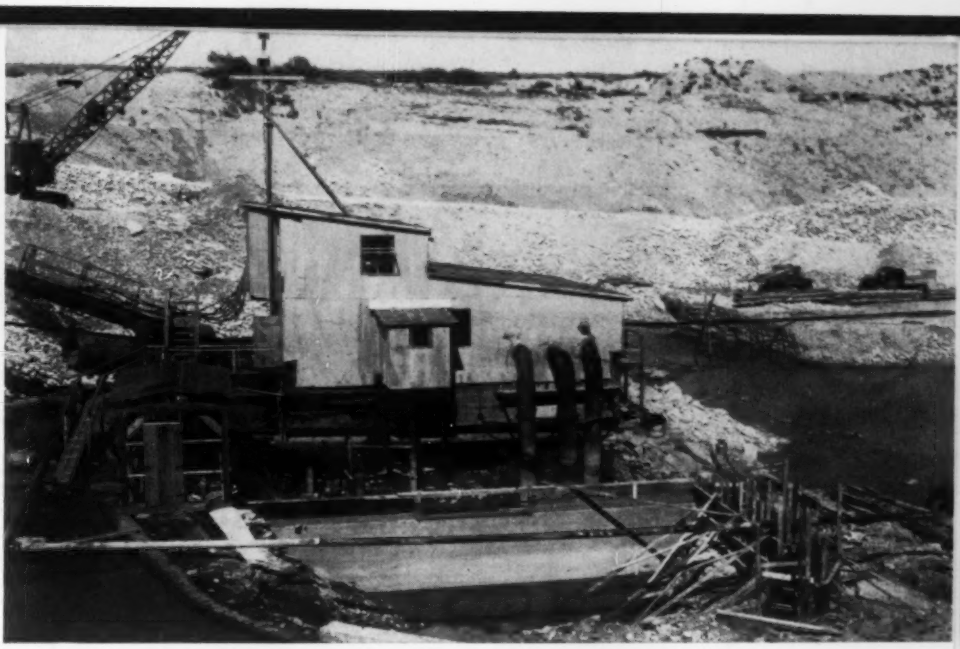
Pumping was continued and the infiltration was found to be only about 5,000 gpm after the banks had drained. The slide, however, filled up the pumping sump, making it necessary to move the pump barge 100 ft out into the pool. A temporary sump was dug and used until the bottom of the original sump had been cleaned out. Four cranes then moved the pump barge back to its original position.

To keep sand from running into the sump, a forebay was installed to act as a settling basin which could be periodically cleaned out by a truck crane. The sump was also screened to prevent debris from entering it. Experience with this installation has shown that it would have been advisable to have one or two open impeller pumps to take care of sand and debris until the forebays and screens could be put in working condition.

Rock Toe Stabilizes Slopes

The method of stabilizing the toe of the slopes was a difficult one to work out as the slopes ended in long, flat, saturated deltas 8 to 12 ft above rock. Water emerging from the slopes eroded them badly. The solution reached after some experimenting was to built a rock toe at the bottom of the slope, on the bedrock, to act as a drain and stabilizer. The drain was installed by digging a short trench 12 to 15 ft wide with a dragline. As the trench was dug in wet sand, it continuously washed in; however, the dragline was able to dig faster than the trench caved, and when the rock floor was reached a bulldozer immediately filled the hole with rock from a stockpile just behind the trench.

After this operation it was possible to excavate the sand from against the inside of the rock trench, and additional rock was placed to form a facing. After installation of the rock toe the water level in the berms fell, and the slopes dried.



FLOATING-TYPE PUMPHOUSE rests over sump blasted out of rock under water. Concrete wall in foreground separates settling basin from sump.

The material for the drain, about 4 cu yd per lin ft, was secured by purchase until rock became available from the excavation. After the technique of building the drain was worked out, a crew could average as much as 200 lin ft of rock drain per shift, and eventually the drain encircled the entire job, making an excellent road.

Before starting the rock excavation, it was necessary to remove 160,000 cu yd of sand and silt, some of which had washed in and some of which had been left by the dredge. Bulldozers running on the rock bottom pushed the material into piles to permit the water to drain off, and draglines then loaded it into 10-cu yd Euclid trucks, which hauled it outside the cofferdam. About 60,000 cu yd were taken out by a 4-cu yd dragscraper bucket on a long-haul cable across the width of the excavation, operated by a Bucyrus Erie 50B Steam Crane. This equipment pulled the material from the bottom and deposited it on the side slopes.

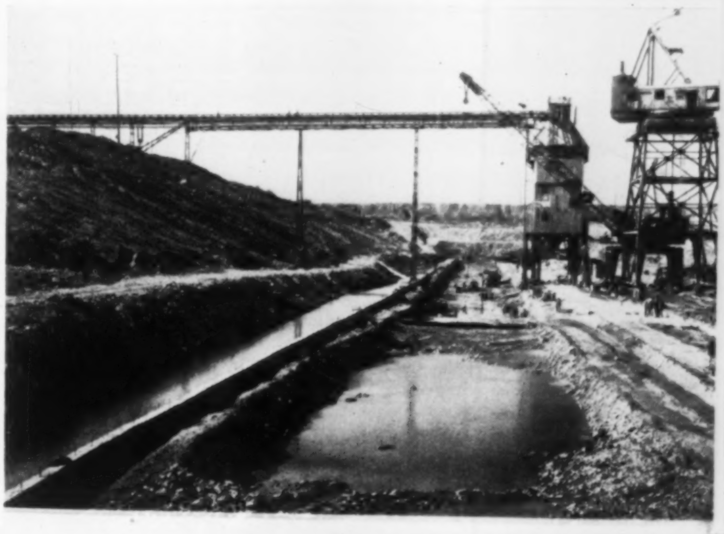
After completion of the rock trench in which the lock walls were to be built, it was necessary to build a small concrete wall at the side of the excavation to prevent water from running into the trench. The water flowed between this wall and the rock dike, and was effectively prevented from running into the excavated area. There was very little seepage through the rock.

The completed cofferdam proved to be an excellent one, requiring unusually low maintenance. The upstream and downstream dikes were widened to 100 ft at the top, and final cofferdam slopes were established at approximately 1 on 3. The infiltration, stabilized at about 5,000 gpm, has not varied with the rise and fall of the Mississippi River as the water in the Cabaret Chute is kept out of the cofferdam by a bottom layer of silt. The low rate of infiltration is due to the fact that the sand is much finer than was shown by the borings. In making the borings much of the fine-grained soil was lost, leaving only the coarser samples—a chronic difficulty in obtaining representative sand samples.

The sand is so fine that it is affected by heavy rains; in one case 3,000 cu yd of material was washed onto the rock floor. This difficulty was controlled by collecting the rain water from terraces constructed along the slopes and conducting it to the rock in pipes.

(*Continued on page 87*)

CONCRETE WALL prevents seepage from flowing into rock trench where lock wall will be poured. Completed rock toe of embankment, at left of concrete wall, provides excellent roadway encircling cofferdam.



Engineers' Notebook

Header Assembly Permits Grouting Against High Hydrostatic Pressures

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TO FACILITATE supplementary grouting operations after Hoover Dam was constructed and the reservoir had filled, a grout header assembly was designed for forcing grout into fissures and crevices containing water under high hydrostatic pressure. This assembly (Fig. 1) was used extensively by Bureau of Reclamation engineers at the dam during the period 1939–1947.

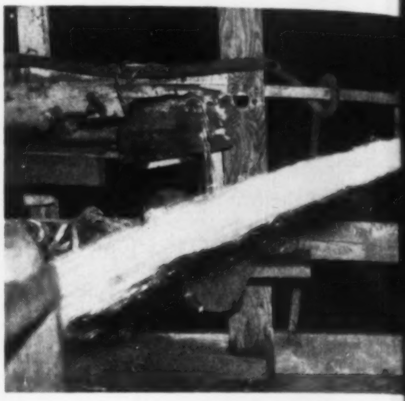
New Design Overcomes Difficulties

Conceived and perfected by O. E. Boggess, Bureau engineer, the device was successfully applied to the grouting of a series of holes that were diamond drilled into the foundation from galleries in the dam and from the concrete-lined tunnels in the abutments where seepage had occurred. As many of the holes emitted large flows of water at high pressures, the usual method of forcing grout through the holes into the seams and fissures could not be used.

To provide an effective seal for the holes, from some of which the flow was as much as 400 gpm, and to prevent the high pressures ordinarily used in grouting operations from being applied directly to the concrete tunnel linings, it was found necessary to insert a packer into the holes. In attempting to start the packer into a hole from which a large quantity of water at high pressure was flowing, Bureau engineers observed that the water pressure would immediately spread the cup leathers of the packer assembly and cause the diameter of the cup leathers to exceed the diameter of the hole. To overcome this difficulty, the grout header assembly shown in Fig. 1 was designed and constructed on the job and proved to be very satisfactory.

Operating Procedure Described

The packer used consisted essentially of four $1\frac{1}{2}$-in.-dia cup leathers, evenly spaced along a 12-in. length of $\frac{1}{2}$-in pipe. The packer was mounted at the end of a $\frac{3}{4}$-in. pipe and inserted at the desired depth, usually 20 ft, into the hole. Grout was pumped through the $\frac{3}{4}$-in. pipe, and only that portion of the hole extending beyond the packer was subjected to the grouting pressure.



EXPLORATORY HOLE DRILLED for 192 ft through wall of Nevada spillway tunnel of Hoover Dam spouts flow of about 400 gpm. Problem of grouting against heads such as this was solved by design of header assembly shown in Fig. 1.

In the following description of grouting operations as carried out at Hoover Dam, valve designations and numerals in parenthesis refer to Fig. 1.

Valve A is attached to the grout nipple (1), which is inserted before the placing of the packer in the hole. The valve is then closed, thereby stopping

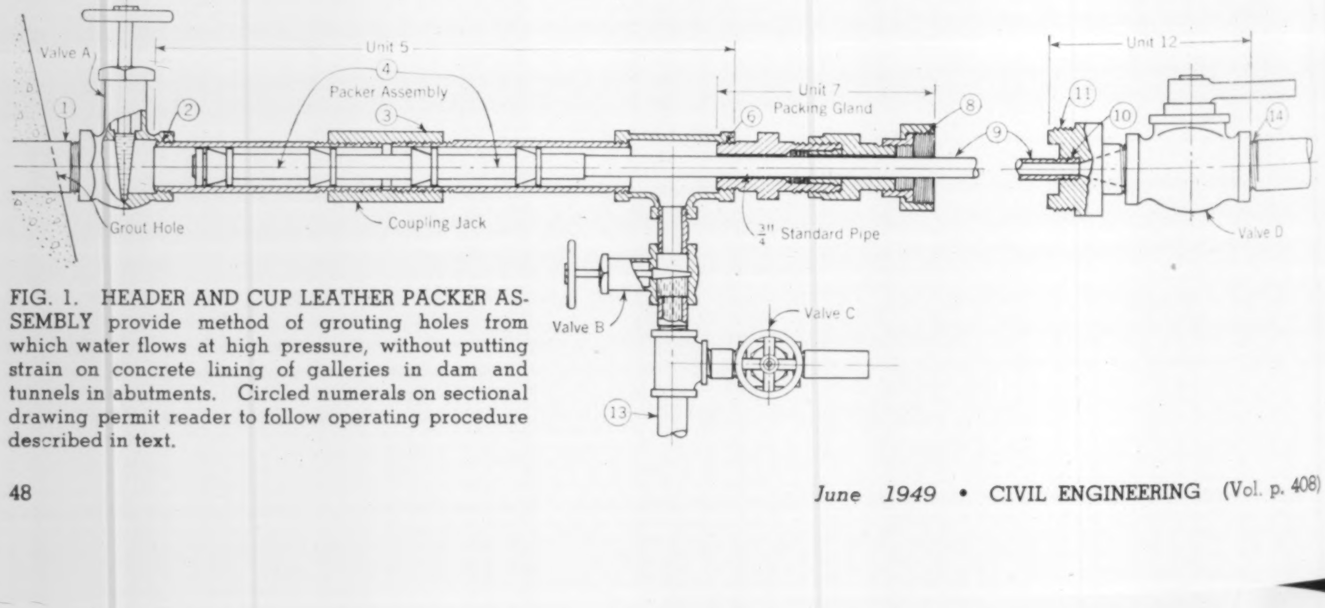


FIG. 1. HEADER AND CUP LEATHER PACKER ASSEMBLY provide method of grouting holes from which water flows at high pressure, without putting strain on concrete lining of galleries in dam and tunnels in abutments. Circled numerals on sectional drawing permit reader to follow operating procedure described in text.

the flow of water from the grout hole. The cup leather packer assembly (4) is placed inside of unit (5) and is connected to pipe (9), which extends through the packing gland unit (7). The length of pipe (9) used depends on the distance it is desired to place the packer in the hole.

Unit (5) is connected to Valve A at (2). Valves B and C are closed, and water under a minimum pressure of 50 psi greater than the water pressure in the grout hole is applied at (13). Valve B is opened, permitting a flow of water around packer (4) and out through pipe (9). This flow has a tendency to force the packer (4) forward against Valve A. Valve A is then opened, and the water flowing through Valve B forces the packer (4), followed by pipe (9), through Valve A, into the hole. If the water pressure at (13) is too great and tends to move the packer (4) too fast, the pressure can be partially reduced by opening Valve C.

After packer (4) and pipe (9) have moved into the hole the desired distance, unit (12) is connected to pipe (9) at (10), and (11) is connected to (8). The water pressure is removed from (13) while Valve B remains open. When Valve D is closed, the grout pump is connected at (14). The coupling jack (3), cut with right-hand and left-hand threads, is used to loosen the packer in the hole after grouting operations have been completed.

... THE READERS Write

Commends Findings of Educational Committees

To the Editor: The survey committees charged with the study of the aim and scope of engineering education, as described by Dr. H. E. Wessman in the April issue of Civil Engineering, are to be commended on the choice of economics, labor relations, American government, psychology, and business law as desirable non-technical subjects to be added to the engineering college curriculum if possible. Considerable emphasis has been placed on the fact that engineers are notably deficient in English composition, report writing, and public speaking, and these particular items have been urged for top precedence.

Something is radically wrong with our preparatory and high school educational system if students enter college deficient and incompetent in composition, writing of simple reports, and vocal expression. I can recall when even grade school teaching in grammar and composition was built around exercises which emphasized and developed systematic and orderly thinking and expression.

Engineering colleges should not be burdened with basic teaching in subjects in which the student should have been well grounded before entrance into college. English composition, writing of reports, and public speaking as engineering college subjects should only be added as advanced developments of previous basic high school training, and should be specifically related to engineering matters. As such, they are highly desirable as primary requisites to an engineering education.

Eric Fleming, M. ASCE
Architect and Engineer
New Brunswick, N.J.

Identifies George Koss as AGC Committeeman

Dear Sir: In the April 1949 issue (page 60) my name has inadvertently been applied to the photograph of George Koss, of Des Moines, Iowa, a very exemplary contractor and one who has been doing a fine job with the Associated General Contractors as chairman of their Highway Division.

I feel that Mr. Koss has been slighted by this error, and that a correction should be made.

Walter L. Couse, M. ASCE
Vice-President, AGC
Detroit, Mich.

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Calls Simplified Design Formulas Practical Aid

To the Editor: Without having had an opportunity to check the figures cited by Mr. Kalivopoulos (in the March issue) with reference to my paper, "Formulas Simplify Design of Concrete Columns Under Axial Load and Skew Bending," in the November number, let me stress at once that my paper was submitted as an aid to designers in engineering offices rather than as a classroom curiosity.

I doubtless should have stated clearly the limitations on the use of the formulas. However, no competent and experienced designer ever follows any formula blindly. The average structural designer meets many problems in his daily life where skew bending introduces inaccuracies into his computations—such as channel purlins on pitched roofs, T-beams having a flange on one side only or having two flanges of unequal size, soil pressure distribution on an unsymmetrical foundation mat, etc. A capable designer immediately senses when he must supplement a formula with his practical experience and good judgment.

I developed the formulas in 1932, and they have since been great time savers on many projects. It seems self-evident that the accuracy to be expected from their use diminishes as the column section deviates more and more from being a square. Moreover, the column section chosen by the discusser is devoid of compressive reinforcement. Offhand I would say that this fact has a tendency to further unbalance the section. My formulas prove that, as a rule, the amount of compressive steel required is far greater than the amount of tensile steel. Hence, a column section with no compressive reinforcement whatsoever, such as the discusser chose, is purely an imaginary section with which the average designer will not be confronted once during his entire career

Carl C. H. Tommerup, M. ASCE
Seattle, Wash.

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America's Longest Concrete Arch Span Is in Brazil

To the Editor: In connection with the article by J. J. Polivka on the Podolsko Bridge, in the January issue, reference is made to "America's longest concrete arch—George Westinghouse Bridge over the Turtle Creek Valley," which has a span of 418 ft.

It may interest readers to know that there is a longer concrete arch span on the American continent. The Rio Tiete bridge at Lussanvira, Sao Paulo, Brazil, built in 1932–1934, has two reinforced concrete hollow box ribs of 426.51-ft span.

Louis Balog
Consulting Engineer
Binghamton, N.Y.

SOCIETY NEWS

Arthur S. Tuttle, Past-President and Honorary Member, Dies

Arthur S. Tuttle, Past-President and Honorary Member of the Society and former chief engineer to the New York City Board of Estimate and Apportionment, died in Brooklyn Hospital on May 19 after a long illness. He was 84. When Mr. Tuttle retired from New York City service in 1933, he had completed 49 years with the Brooklyn Water Supply and the New York Board of Estimate. Twice cited for exceptional public service by Mayor LaGuardia, he was the first to receive two such citations.

As chief engineer of the Board of Estimate and Apportionment, Mr. Tuttle was instrumental in bringing about the West Side Improvement, which included construction of the West Side Highway and elimination of the New York Central Railroad tracks through the city. As state director of the Public Works Administration for New York, he represented the federal government in the construction of engineering projects totaling more than $800,000,000. He was also federal project engineer and acting project engineer on construction of the Triborough Bridge, the Lincoln Tunnel, and the Queens Midtown Tunnel. At the time of his death, he was chairman of the board of the Tuttle-Haller Companies, New York engineering, inspecting, and testing firms.

Past-President Arthur S. Tuttle (1865–1949)

A veteran member of the ASCE, Mr. Tuttle was third on the list of oldest members in point of connection with the Society, having joined as a Junior in 1887. He had held every elective office from Director to President (1935), with the exception of the Secretaryship and he was made an Honorary Member in 1938. He had also served on many Society committees and as president of the Metropolitan Section. He was indefatigable in service—no assignment was too arduous or too trifling.

Mr. Tuttle was a member of the New York University class of 1886 and, at the time of his death, had been on the university's governing council for 30 years. He was a former chairman of the John Fritz Medal Board of Award and past-president of the Municipal Engineers of New York and of the Engineers' Club in New York. In 1942 he was made a doctor of engineering at Rensselaer Polytechnic Institute.

He was also a member of the United Engineering Trustees, the American Institute of Consulting Engineers, the Regional Plan Association, the American Shore and Beach Preservation Association, Tau Beta Pi, and Delta Phi. Author of many articles for the technical press, Mr. Tuttle had been on the editorial advisory board of *Sewage Works Engineering*.

Funeral services for Mr. Tuttle were held at St. Ann's Church, Brooklyn, May 21. Society members serving as honorary pall bearers included W. J. Shea, C. E. Trout, W. N. Carey, C. A. Riedel, Malcolm Pirnie, E. E. Seelye, Ole Singstad, and W. W. Brush.

Pacific Northwest Sections Study Local Problems in First Regional Conference

Wide coverage was given Local Section problems by representatives of five Sections—Montana, Oregon, Tacoma, Seattle, and Spokane—attending the first annual Pacific Northwest Conference of Local Sections at Spokane on May 14.

Thomas H. Campbell was moderator of a symposium on Local Sections that led off with a paper on ways of making the Local Section dollar go farther by Harold J. Doolittle, of the Spokane Section. The second paper, presented by Gordon K. Ebersole of the Montana Section, dealt with "Branch Sections and Their Relationship to an Expanding ASCE Program."

In a talk on "Integration of Juniors in Section Activities," Guy Taylor of the Oregon Section, emphasized the necessity of meeting Juniors on an equal footing and of inducting them into Society and Section work by assignment to committees and as officer aides. The group decided to make a special study of Junior relationships in the various Sections as the basis of a report, to be presented at the next regional conference. R. O. Sylvester, of the Seattle Section, spoke on the boundaries of Districts and Zones, outlining the history of the Harrington report and reading a letter of comment from Vice-President Cunningham.

A panel discussion on the controversial Columbia Valley Authority proposal was presented by J. K. Cheadle, Spokane attorney, and Prof. R. G. Tyler, of the University of Washington. Mr. Cheadle advanced the possibility that the proposed CVA might violate certain state rights and be so autonomous that it would not be responsible to Congress as are the Army Engineers and Bureau of Reclamation. Professor Tyler stated that there was nothing in the bill as proposed to indicate violation of state's rights and that added efficiency in the development of the Columbia would result from an over-all authority.

During the Conference business meeting, J. L. Stackhouse, of Tacoma, was elected president; Thomas H. Campbell, of Seattle, vice-president; and F. D. Langdale, of Tacoma, secretary. Mr. Stackhouse served as temporary president of the Conference. ASCE Director W. L. Malony reported briefly on the Society's Oklahoma Meeting, and an inspirational talk by Mr. Langdale on the future of the Pacific Northwest Conference concluded the program.

Malcolm Pirnie Honored at E.I.C. Annual Meeting

A HIGH LIGHT of the 63rd annual meeting of the Engineering Institute of Canada, held at the Chateau Frontenac in Quebec, May 11 to 14, was the conferring of honorary membership on ASCE Past-President Malcolm Pirnie. A recent Hoover Medalist, Mr. Pirnie was cited for "his outstanding character and achievements," and his record was acclaimed as "a splendid example of the full life as it may be lived by the engineer and as an inspiration to all."

Canadian hydroelectric projects, highways, and airplane developments were the topics on the technical program. Individual addresses and panel discussions on problems of industrial management, presented under the joint auspices of the E.I.C. and the International Committee of Scientific Management, drew speakers from the United States and Brazil. The total registration for the four-day meeting was over 1,000.

The incoming president of the Institute is J. E. Armstrong, chief engineer of the Canadian Pacific Railway, who succeeds J. N. Finlayson, M. ASCE, dean of the Faculty of Applied Science, University of British Columbia.

ASCE was officially represented at the meeting by E. L. Chandler, Assistant Secretary.

ASCE PAST-PRESIDENT MALCOLM PIRNIE (right in right-hand photo) is presented with honorary membership in Engineering Institute of Canada by J. N. Finlayson, outgoing president, at recent annual meeting of Institute in Quebec. J. E. Armstrong, newly elected president, is shown in photo at left.

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Society Adopts Group Plan of Disability Insurance

AFTER NEARLY TWO years of comprehensive study by the Committee on Employment Conditions, the Board of Direction, has adopted group purchasing of Health and Accident Insurance which is now available to all eligible members. As announced in the May issue, the Board gave approval to adoption of the plan at its Oklahoma City meeting, stating that, "the group health and accident insurance plan proposed is said to make such insurance available to all members on a group basis at a cost materially less than similar insurance might be had on an individual basis."

One of our most important assets is our earning power. Generally speaking, it is the prime requisite for acquiring and holding any other assets we may have or hope to have. Recognizing the need of protecting our earning power, the Committee studied various group disability plans. It became apparent that the wholesale purchasing power of the membership of the Society made it possible to secure much broader coverage at a substantially lower cost than any member could buy as an individual. The Committee further learned that other societies similar to ours have made similar insurance available to their members. Outstanding among these professional groups are architects, certified public accountants, lawyers, doctors, and dentists.

After a thorough investigation, supplemented by an investigation by the Society's legal counsel and an independent firm of actuaries, the Committee unanimously recommended the Group Plan of Disability Insurance underwritten by the Continental Casualty Company. The plan will provide for individual policies purchased by a large number of ASCE members as a group. Claims under these policies will be settled by the nearest service office of the insurance company, which has offices in many of the larger cities of the country.

The success of the plan depends, of course, upon the desire and active support of the membership, and it is hoped that the various Local Sections will be advised of details of the plan and the advantages of the insurance can readily be made known to every member.

Among the outstanding advantages of the insurance, as seen by the Committee and the Board, are the following:

1. The individual policy cannot be cancelled or renewal refused by the insurance company for any member of the Society up to age 70 so long as the premium is paid and the plan is in effect with the Society.
2. There are no restrictions as to the date of origin of any disease.
3. House confinement is never required.
4. Indemnities cannot be prorated because of other insurance.
5. Insurance cannot be restricted by rider to exclude any ailment or to reduce coverage.
6. There are no exclusions except war, suicide, and private flying.
7. No medical examination or other evidence of insurability is required during an open enrollment period.
8. All members in active practice under age 70 are eligible to apply, regardless of age, sex, or physical history during an open enrollment period, but for some substandard risks acceptance for coverage will depend on the enrollment of 50 percent of an entire Local Section.

All of these benefits are available as soon as 50 percent of a Local Section has been enrolled. In administering the plan, the company will not require participation of 50 percent of a large Local Section. It is assumed that the minimum group will be at least 100. Subdivisions of large Local Sections will be considered, and small Sections will have to combine to provide a group of minimum size. In the meantime, however, the insurance company has agreed to make the coverage effective on the insurable members so there will be no undue delay for those members who meet the few requirements that are necessary. There will be some members, however, who will not be able to obtain this insurance until the 50 percent participation has been reached. It should be to the advantage of each Section to promote the program wholeheartedly for the benefit of all concerned.

Descriptive booklets from the insurance company will reach all members shortly, and it is urged that each member give the matter serious consideration. If members all cooperate, the plan can be put into effect before the summer months.

The Board of Direction feels that this is a worthwhile project and deserves the full cooperation of all members.

AS ANNOUNCED in the April issue, the "Glossary: Water and Sewage Control Engineering," is now ready for distribution in attractive paper and cloth bindings at popular prices. This 276-page book has the endorsement of the Society, the American Public Health Association, the American Water Works Association, and the Federation of Sewage Works Associations. A convenient order blank will be found on page 109 in the advertising section.

Tips to Members Attending ASCE Convention in Mexico City

ROBERT B. BROOKS, Vice-President of ASCE

AMERICAN ROAD MACHINERY is at work on highway construction in Zacatepec in upper view. Amatitlan Bridge in Puebla, shown in lower photo, is typical of modern Mexican projects.

THE SUMMER CONVENTION in Mexico City will not only give members of the Society an unexcelled opportunity to further international relations among the engineers of a friendly neighbor state, but also to study Latin-American engineering problems on the spot and to learn how engineers of a different country approach their engineering problems. Six Technical Divisions are featuring many papers by Mexican engineers on Mexican water, irrigation, and other projects. In addition there will be a wide choice of inspection trips to engineering projects in the Mexico City area. [Full details of the technical sessions and tours are given in the program, pages 17–21]

Sightseeing Opportunities

There will be unequalled opportunities for sightseeing. To mention a few, you can make a Sunday trip to Puebla, attend Mass, and watch the Mexicans turn out in festive dress, the *charros* (cowboys) in expensive doeskin suits covered with gold and silver, sitting in saddles worth thousands of dollars. You can marvel at the athletic skill shown at the Sunday afternoon bullfights. You will see the National University of Mexico, predating our own William and Mary College and Harvard University by over a century.

Nowhere on this continent will you have a chance to see such sights as the Floating Gardens of Xochimilco; the Chapultepec Castle and Gardens, home of the ill-fated Austrian Archduke Maximilian and his wife Carlotta; and the famous snow-capped volcano Popocatepetl. The Pyramids of the Sun and Moon, built 2,000 years ago, are larger than the pyramids of Egypt. All these places can be reached by railway or modern highways.

Those wishing to take longer trips out of Mexico City can see world-famous Taxco, where houses and streets are as they were hundreds of years ago, and ancient silver mines are still being worked. You can also visit Fortine de los Flores, where gardenias are thrown into your swimming pool. The American Express lists four trips, ranging in length from three to nine days and in cost from $18.50 to $75. Your nearest American Express Office can provide information on traveling expenses.

Advice to Motorists

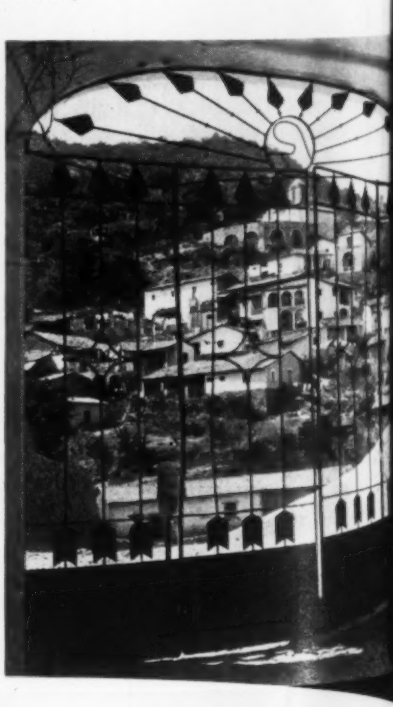
Motorists will enjoy the good highways and the scenery ranging from tropical jungles to mountains.

If you are traveling by car, be sure your insurance covers Mexico, or else buy insurance in San Antonio or Laredo, Tex. Also, take spare tires and inner tubes as well as a full complement of tools and wrenches. The climate in Mexico varies. It is likely to be warm and clear in the daytime, but cool at night, and there are occasional showers. So be sure to take an overcoat and also a raincoat. Remember the altitude is over 7,000 ft.

Refrain from eating raw fruit, that cannot be peeled, or uncooked vegetables and salad. It is advisable to take bottled water from your hotel.

Living costs are not high. A two-week tour from St. Louis to Mexico City by rail or air can be arranged for $380, a three-week tour for $559. All reservations should be made at least three or four weeks in advance, as tourist travel to Mexico is increasing steadily. ASCE Headquarters will furnish all necessary information on reservations and rates.

[*Editor's Note:* Vice-President Brooks has made numerous visits to Mexico City and is an authority on what to see and do. He is a member of the executive committee in charge of meeting arrangements.]



LA ANGOSTURA DAM IS UNDER CONSTRUCTION on Bavispe River in State of Sonora in photo at left. In right-hand view, tower of one of picturesque churches at Cuernavaca, a few miles from Mexico City, rises behind old stone cross in courtyard. Cuernavaca is site of famed Borda Gardens and Palace of Cortez.

Eleven Regional Spring Conferences Are Sponsored by ASCE Student Chapters

LARGE-SCALE REGIONAL conferences, sponsored by ASCE Student Chapters in all parts of the country during the past spring, served as a clearing house for discussion of vocational and professional problems. Eleven of these conferences—the New England, Upstate New York, Philadelphia-Lehigh Valley, Maryland-District of Columbia, Virginia, North Central, Mid-Western, Texas, Rocky Mountain, Pacific Northwestern, and California Conferences—are summarized here.

New England Conference

Career opportunities for young engineers were reviewed in a series of round-table talks featuring the New England Conference, which took place at Tufts College, Medford, Mass., on May 7, in conjunction with the annual regional conference of New England Local Sections (Connecticut, Northeastern, and Providence). Other speakers during the all-day session included Dean Harry P. Burden, of Tufts College; Arthur L. Shaw, president of the Northeastern Section; and Nathaniel Clapp, chairman of the Committee on Student Summer Employment.

Prize winners in the annual student prize paper competition were Michael Lash, Tufts College; Conrad E. Wysocki, Yale University; and Richard Rashind, Northeastern University. New student officers for the 1950 conference, elected during the business meeting, are Conrad E. Wysocki, of Yale, chairman; Melvin Rubin, of Tufts, vice-chairman; and John B. Wilbur, Jr., of Massachusetts Institute of Technology, secretary-treasurer.

In the leading address of the program, Brig. Gen. James F. McManmon, Massachusetts State Commissioner of Airport Management, told the students that their future is largely in their own hands. Speaking on the topic, "Quo Vadis," before the joint group at the concluding banquet, which was sponsored by the Northeastern Section, General McManmon urged the students to avoid "the fear and uncertainty of this generation that exist in the very midst of opportunity. Employment, generally, is still at a high level, and skilled engineers, in particular, are exceptionally scarce. The economic pattern of the nation is still good, and it is your job to keep it so or make it better," he declared.

Emphasizing the importance of engineering education to the life of the nation, General McManmon quoted from Winston Churchill's recent address at MIT: "'We have suffered in Great Britain from the lack of colleges of university rank in which engineering and allied subjects are taught. Industrial production depends on technology, and it is because the Americans have realized this and created institutions for the advanced training of large numbers of high-grade engineers to translate the advances of pure science into industrial technique, that their output per head and consequent standard of life are so high.'"

In conclusion, General McManmon said, "You are surrounded by opportunity. You are standing at the crossroads of this great country, if not the world. The way is open, and because you have the good fortune to be in America, you are not regimented into a decision. The right road is yours, and yours alone to select—quo vadis?"

Upstate New York

The Union College Student Chapter recently was host to the first postwar conference of Upstate New York Chapters, which was attended by more than 100 delegates from Rensselaer Polytechnic Institute, Syracuse University, Clarkson College, and Union.

The morning was devoted to tours of the new General Electric turbine building, the American Locomotive Co. shops, and the Union College civil engineering laboratories, and the afternoon to a student prize paper contest. First prize of $25 was awarded to Frank Moffitt and Robert McGivern, of Syracuse University, for a paper on "Topographic Mapping with the Multiplex," and second prize of $10 to Michael Setne, of Union, for a paper on "Soil Consolidation Testing." The cash awards were sponsored by the Hudson-Mohawk Section.

New York State's present highway needs were reviewed at the evening dinner meeting by Fred W. Fisch, director of the Bureau of Arterial Route Planning, New York State Department of Public Works. Mr. Fisch stressed the inadequacies of our highways which, he said, are still suffering from the neglect of the depression and war years, and described New York's plans for highway modernization.

William Pahl, Jr., president of the Union College Chapter, was conference chairman.

Philadelphia-Lehigh Valley

The eleventh annual conference of Chapters in the Philadelphia and Lehigh Valley Sections, held at the University of Pennsylvania in Philadelphia, was attended by 330. Speakers at the all-day conference included A. V. Levergood, president of the host Chapter; Dean John A. Goff, of the University of Pennsylvania; L. V. Fisher, Contact Member for the Lafayette College Chapter; Edwin L. Shoemaker, president of the Philadelphia Section; and Prof. Samuel T. Carpenter, head of the civil engineering department at Swarthmore College and chairman of the Philadelphia Section Committee on Student Chapters.

Seven technical papers were presented in a competition for prizes offered by the sponsoring Sections. First prize winner was Francis J. Casey, of Villanova College, who dealt with the subject, "Vermiculite, a New Lightweight Aggre-

GROUP OF DELEGATES ATTENDING MARYLAND–DISTRICT OF COLUMBIA CONFERENCE observes rotary distributor on trickling filter in operation at Back River Sewage Disposal Plant, Baltimore.

DR. ABEL WOLMAN, HEAD OF SANITARY ENGINEERING DEPARTMENT at Johns Hopkins, addresses banquet of student group attending Maryland–District of Columbia Conference.

gate." Second and third prizes went to Roland Y. Smith, of Lehigh University, for a paper entitled, "Model Study of the Little Pine Creek Dam Outlet Structure," and Norman A. Katz, of Drexel Institute of Technology, for his treatment of the Conowingo Project.

Extension of the Market Street Subway in Philadelphia, a current project of the Philadelphia Department of City Transit, was described in the principal address of the afternoon session by Howard S. Hipwell, chief engineer of the department. The group then adjourned for an inspection trip to the project.

Maryland–District of Columbia

Thin-shelled concrete structural forms, developed during the war to offset the steel shortage, were discussed by Arsham Amirikian, principal engineer for the Bureau of Yards and Docks, in the leading technical talk at the recent Maryland–District of Columbia Conference at Johns Hopkins University. Prof. J. Trueman Thompson, chairman of the civil engineering department at the host college, also spoke briefly, and the afternoon was devoted to an inspection tour of the Baltimore Sewage Disposal Plant at Back River.

In a review of "Job Opportunities for Engineers," given at the evening dinner meeting, Dr. Abel Wolman, chairman of the sanitary engineering department at Johns Hopkins, emphasized the vast amount of engineering work that will be required in the United States in the next 20 years. The rest of the world also presents a tremendous challenge, Dr. Wolman said, pointing out that "some 500,000,000 people exist at starvation level, although land and working forces are ample for a much higher living standard. Since most of the industrial development and technological skill of the world is concentrated in this country, the development of the rest of the world offers both a great opportunity and a challenge to the young engineer," he declared.

Participating Chapters were Catholic University, George Washington University, the University of Maryland, and Johns Hopkins University. The conference was the eighth held in the region, and the third at Johns Hopkins.

North Central Conference

Representatives from 20 Chapters in Ohio, Kentucky, Indiana, West Virginia, Michigan, and western Pennsylvania attended the North Central Conference, to which the Case Institute of Technology in Cleveland was host.

Speakers on the two-day program included Prof. Leslie J. Reardon, of Case Institute, who discussed building codes; Thomas Smull, chairman of the Ohio State Board of Registration for Professional Engineers and Surveyors, who described the professional registration situation; and C. Merrill Barber, Cleveland consultant, whose subject was "Toll Roads, Past, Present and Future." An evening banquet, with Prof. G. Brooks Earnest acting as toastmaster, was followed by a tour through the Institute observatory and lecture by Dr. S. S. Nassau on "Science and the Modern World."

Inspection trips were made to several Cleveland construction projects, including the Nottingham Water Intake and the Willow Freeway.

Virginia

The importance of human relationships to successful engineering was stressed by Wert Faulkner, general manager of the Jas. Lees & Sons, in the principal talk before the Virginia Conference, which met at Virginia Military Institute at Lexington on May 6. Following his talk, Mr. Faulkner led a motor cavalcade to inspect the company's new plant at Glasgow, Va., which treats all waste from the industrial operation.

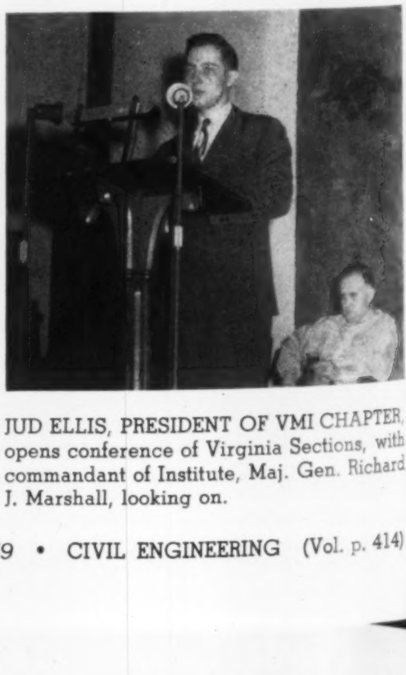
An address, entitled "Organization of the Engineering Profession," was presented by Don P. Reynolds, Assistant to the Secretary of ASCE, and Student Chapter activities were reviewed by Prof. J. M. Faircloth, Faculty Adviser for the University of Alabama Chapter and member of the ASCE Committee on Student Chapters.

Presiding for the host Chapter was Cadet J. M. Ellis, president of the VMI Chapter. The welcome of the Institute was extended by Maj. Gen. Richard J. Marshall, superintendent, and Col. R. A. Marr, Jr., Faculty Adviser and head of the civil engineering department. Members of the Student Chapters at Virginia Polytechnic Institute and the University of Virginia joined the VMI cadets for the conference.

Mid-Western Conference

A symposium on engineering projects in the Chicago area featured the Fifth Annual Conference of Mid-Western Chapters, held at Northwestern University, Evanston, Ill. Development of the Chicago water supply was detailed by W. W. De Berard, city engineer. Virgil E. Gunlock, city commissioner of subways and superhighways, explained the planning and construction of the Chicago subway and express highways, and Lt. Col. Frank Milner, district engineer for the Corps of Engineers at Chicago, spoke on the Illinois Waterway and commercial navigation facilities in the area.

Later the delegates had their choice of field trips to the Chicago subway and express highway, the South District Filtration Plant, the North Side Sewage Treat-



JUD ELLIS, PRESIDENT OF VMI CHAPTER, opens conference of Virginia Sections, with commandant of Institute, Maj. Gen. Richard J. Marshall, looking on.

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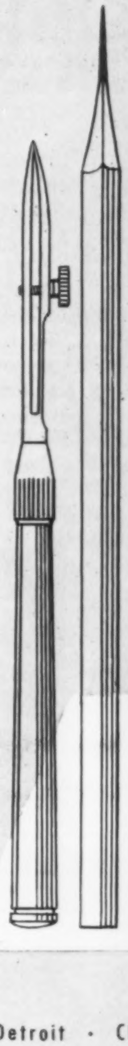

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ment Works, or the Outer Drive Bridge and Chicago River Locks.

Three round-table discussions of student problems were conducted by the following Student Chapter representatives: Will Kautz, Illinois Institute of Technology; F. W. Smith, University of Illinois; R. L. Coats, University of Iowa; Don Dencker, University of Minnesota; Milton J. Schroeter, University of Wisconsin; James Martin, South Dakota State College; Jeremy Zimmerman, Northwestern; W. P. Gillespie, University of Illinois (Navy Pier Branch); Roy R. Virden, University of North Dakota; S. L. Zeid, Rose Polytechnic Institute; Robert C. Gates, Northwestern; Robert D. Davies, Iowa State College; Jack C. Price, Michigan College of Mining and Technology; Richard Kraus, Marquette University; Vernon Mickleberry, Purdue; Oliver Hinsman, Notre Dame; and Roy Weigel, North Dakota Agricultural College.

The committees in charge of the two-day program were headed by R. Disque and T. Breitfuss, of the host Chapter, as conference chairman and secretary.

Rocky Mountain Conference

Delegates from the University of Colorado, Colorado A. & M. College, and the University of Wyoming Chapters attended the recent Rocky Mountain Conference, to which the University of Wyoming was host. The total attendance of 128 included a group from Denver University, which does not as yet have a Student Chapter. Melvin Webb, president of the University of Wyoming Chapter, opened the conference, and addresses of welcome were given by Prof. H. T. Person, dean of engineering, and Prof. A. J. McGaw, head of the civil engineering department, University of Wyoming. Following the presentation of student papers, H. S. Sweet, assistant professor of civil engineering, discussed concrete aggregates.

Luncheon, at which the students were guests of the Monolith Portland Cement Co., was followed by a tour of the company's cement and aluminum plants south of Laramie. Later the group returned to the campus for inspection of the $5,000,000 program of building construction in progress there.

ASCE Vice-President John W. Cunningham spoke on the activities of the Society and described their effect on the entire engineering profession at the banquet concluding the conference. Prizes were awarded for the best papers presented during the morning session to Wendell Sivers, of the University of Colorado; E. A. Winters, of Colorado A. & M. College; and William A. Eads, of the University of Wyoming. The Associated General Contractors, in cooperation with the AASHO National Essay Contest, then presented four prizes for the best University of Wyoming papers on the subject, "Why I wish to Be a Highway Engineer." First prize of $40 was won by James Desmond, second prize of $25 by Donald Kay, and third prize of $10 by Duane Manfull. A prize of $25 went to Prof. H. S. Sweet for the best faculty paper.

Texas Conference

All five engineering schools in the Texas Section area were represented at the Texas Conference of Student Chapters, held at San Angelo, Tex., April 28–30, in conjunction with the spring meeting of the Texas Section.

Highlight of the meeting for the students was the traditional student breakfast, to which the Section was host. In a brief talk to the Chapter, ASCE President Franklin Thomas said that young engineers, to enjoy success in the profession, "must forget the prevailing selfish attitude that demands security first, and adopt an attitude of service." Moreover, he declared, since a career begins in school, not after graduation, service is probably best rendered by group activity, such as Student Chapter participation. President Thomas then presented prizes in the annual student competition.

First prize of $25 went to Michael D. Altfillisch, of the University of Texas, and second prize of $15 to Leon Marshall, of Southern Methodist University and

Pacific Northwestern Conference

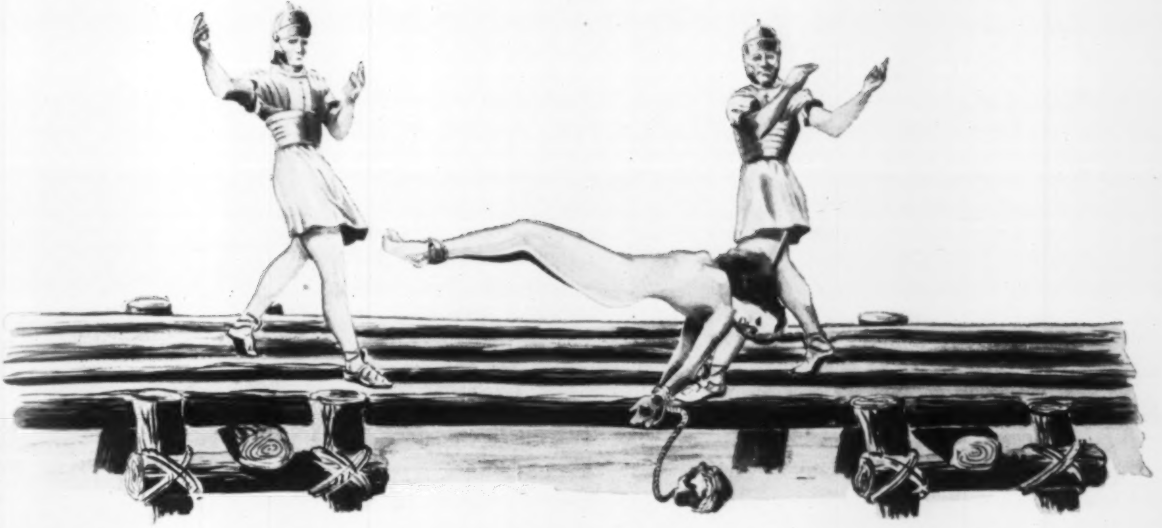
A panel discussion on "What Is Expected of Engineering Graduates," was a highlight of the Pacific Northwestern Conference, held in Pullman and Spokane, Wash., and Moscow, Idaho, April 27–30, under joint sponsorship of the Chapters at Washington State College and the University of Idaho. Leading the panel discussion were Col. William Whipple, district engineer, U.S. Engineer Office; A. J. Davidson, office engineer, U.S. Bureau of Reclamation; William Hughes, city engineer of Lewiston, Idaho; and T. E. Judd, engineer, Washington Water Power. Colonel Whipple was also the speaker at the annual banquet, where his subject was McNary Dam. Another leading technical talk was given by R. E. Koon, Portland consultant, who discussed sanitary engineering.

Inspection trips were made to the Pullman Sewage Disposal Plant, now under construction, the Spokane water plant, the Permanente Metals Corp. rolling mill, and other Spokane projects.

Winners in the student papers competition were Hugh I. Jeffries and George A. Blyth, of Montana State College, and Robert H. Jeffries, of the University of Idaho. A permanent conference organization has been formed, headed by Al Kraft, as president, and William Hallerd, as secretary. Both are students at Montana State College, which will be host to the 1950 conference.

Participating colleges, in addition to the host Chapters, were Montana State College, the University of Washington, and Gonzaga University, with a total attendance of about 150. Vern Verhei, of Washington State College, was chairman of the committee in charge of arrangements.

SPEAKERS' TABLE AT ANNUAL BANQUET OF PACIFIC NORTHWESTERN CONFERENCE shows left to right, starting at head of table, John Mayo, president of University of Idaho Chapter; A. J. Davidson, U.S. Bureau of Reclamation; L. B. Almy, Faculty Adviser, Washington State College; Fred Rhodes, Faculty Adviser, University of Washington; William Hughes, city engineer, Lewiston, Idaho; Col. William Whipple, principal speaker; William Burns, University of Idaho Student Chapter; Mrs. Burns; and Dean A. S. Janssen, of University of Idaho.



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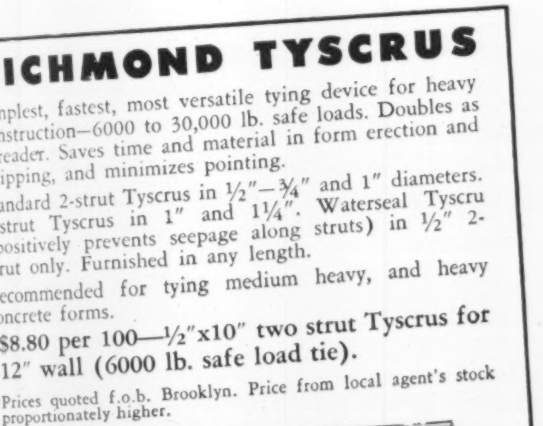

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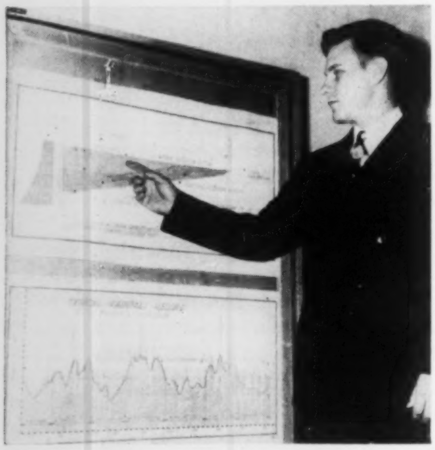
MANUFACTURERS OF ENGINEERED TYING DEVICES, ANCHORAGES AND ACCESSORIES FOR CONCRETE CONSTRUCTION outgoing chairman of the Student Chapter Conference. Three "participating prizes" of $10 each were awarded to Earl Wilson, of Texas Technological Institute, W. E. Moreland, of Texas A. & M., and M. H. Thibodeaux, of Rice Institute, for winning a place in the Texas Conference in preliminary Student Chapter contests.

California Conference

Plans to eliminate the serious water shortage facing the City of Santa Barbara, Calif., were described by John Heath, Jr., of the California Institute of Technology Chapter, in the paper winning first prize in the California Conference of Student Chapters student paper competition, held at San Diego in conjunction with the recent California Conference of Local Sections (May issue, page 58). Mr. Heath said that "present use by the city of Santa Barbara of its existing water sources exceeds by one-third the safe yield from these sources, even though rationing has been in effect most of the past year. The area has grown in population to 50,000, and is expected to have a population of 100,000 by the turn of the century."



WITH AID OF CHART (upper photo), John Heath, Jr., of Caltech., presents paper on Santa Barbara water supply in student paper competition at California student conference. In view below, Mr. Heath is congratulated by ASCE President Franklin Thomas on winning first prize.

Stating that the area has no claim on Colorado River water and that, in any case, the cost of an extension to the Colorado River Aqueduct would be prohibitive, Mr. Heath described a $32,000,000 Bureau of Reclamation project that will be started this summer to relieve the shortage. This project, he said, will consist of "the earthfill Cachuma Dam on the Santa Ynez River 15 miles downstream from Gibraltar Dam, the six-mile Tecolote Tunnel, three regulating reservoirs on the ocean side of the mountains and a 28-mile conduit to the city. The Cachuma Dam will contain 7,000,000 cu yd of earth, have a crest length of 2,000 ft, and be 275 ft in height above bedrock. It will store 210,000 acre-ft, of which 30,000 acre-ft will be dead storage to provide for future silting. It is estimated that the safe yield from this reservoir will be 33,000 acre-ft, which is more than enough to take care of future needs and will allow the ground-water supplies of the area to be replenished. The concrete spillway will have a capacity of 112,500 cfs, 50 percent larger than any known flood.

"The six-mile Tecolote Tunnel to be constructed first to solve present water needs, will be a standard 7-ft horseshoe section, concrete lined except for weepholes that are estimated to yield 5,000 acre-ft annually for the next ten years, decreasing somewhat after that. This tunnel will carry water from the reservoir under a head of 150 ft to the coast area, whence it will be distributed through the conduit. The tunnel will cross a number of earthvuake faults, but no special provision is being made for them as they are considered to be dead.

"Negotiations are now being conducted by the Bureau of Reclamation and the county water districts involved for the repayment of the cost of the project over a period of 50 years. Construction on the tunnel is expected to begin this summer. The repayment contract contemplates a rate of $35 an acre-ft for municipal supplies and $25 an acre-ft for agriculture purposes.

"This is the first project that the Bureau of Reclamation has undertaken to supply both municipalities and agriculture with supplies of water, and the culmination of this project in three years will insure a safe future and adequate water supply for the city and its surrounding agricultural area."

Other highlights of the conference program included a round-table discussion of Student Chapter problems and interests. Jesse L. Kitchens, president of the University of Southern California Chapter, was conference host, and Robert H. Born was chairman of the committee in charge of arrangements. Caltech will be host to the 1950 student conference.

Professional Guide for Engineers Issued by ECPD

A COMPLETE VOCATIONAL guide to a successful engineering career, entitled *A Professional Guide for Junior Engineers*, has just been issued by the Engineers' Council for Professional Development. Written in first draft by the late Dr. William E. Wickenden, for 18 years president of Case Institute of Technology, the work was edited by G. Ross Henninger, director of publications for the Illuminating Engineering Society, following Dr. Wickenden's death in 1947.

The 56-page publication seeks to give the young engineering graduate a sense of professional values in chapters on engineering origins, the what and why of a profession, the engineer in his professional relationships, and in Dr. Wickenden's famed essay on a philosophy of life, "The Second Mile." In addition, there is full treatment of the practical side of getting an engineering job and of advancing in the profession after a job is obtained. The engineer's relation to society is emphasized in chapters on legal registration and unionization.

Addenda to the book are the ECPD credo, "Faith of the Engineer," a recommended Reading List for Junior Engineers, a self-appraisal questionnaire, and the Canons of Ethics for Engineers.

Copies of the guide may be purchased from the ECPD headquarters, 29 West 39th Street, New York 18, N.Y., for $1.00 each, and for 75 cents each in lots of more than ten. For convenience in ordering, a special blank is provided on page 98 of the advertising section.

◆

Dam Club of C.C.N.Y. Sponsors Prize Contest

TWO PAPERS ON THE Delaware water supply system won prizes in the recent McLoughlin Student Paper Prize Competition, sponsored by the Dam Club of the City College of New York for members of the C.C.N.Y. Student Chapter. First prize went to Peter Di Legge for a paper on special features of the system, and third prize to George Carlson for his coverage of general features of the project. Winner of the second prize was Abraham Solganick, whose paper was on "Construction of the Governor's Island Ventilation Shaft of the Brooklyn-Battery Tunnel."

The competition honors the memory of Frederic O. X. McLoughlin, M. ASCE, professor of civil engineering at C.C.N.Y., who died in 1936. Professor McLoughlin sponsored student paper contests, in which the award was the entrance fee and dues for ASCE Junior membership.

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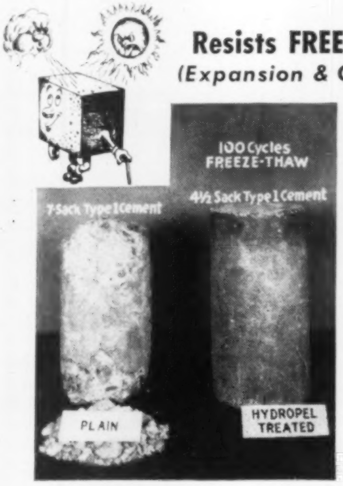
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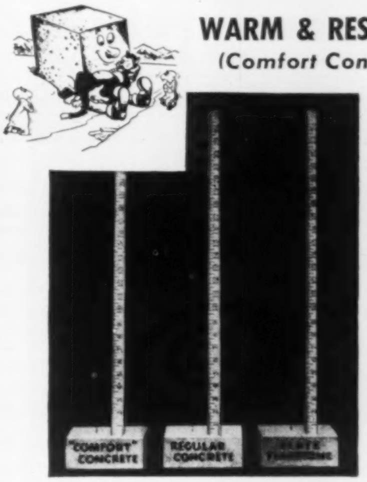
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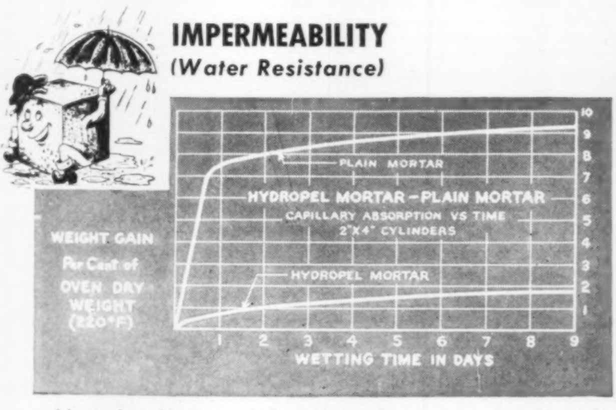

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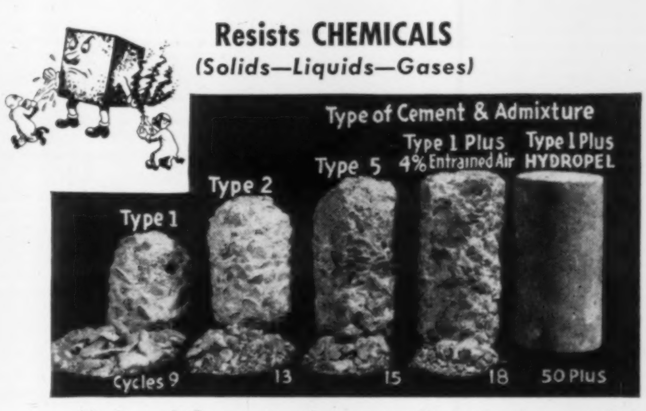
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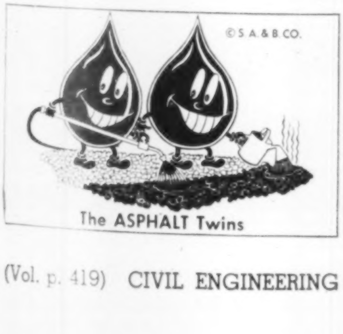
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American Engineers to Present Papers at Rio de Janeiro

Over 60 papers by American engineers are scheduled for presentation at the first Pan-American Engineering Congress, to be held in Rio de Janeiro, Brazil, July 15 to 24. Authors of these papers, which deal with various phases of transportation, communication, construction, power, urban and rural engineering, sanitation, industrial engineering, mining, and engineering teaching, include about 20 ASCE members.

Representative groups of engineers in each country—under the direction of F. Saturnino de Brito, president of the South American Union of Engineering Associations—are cooperating on a hemispheric scale to make the meeting outstanding. Although engineers from all the Latin-American countries have met before, this will be the first congress to which engineers from the United States and Canada have been invited as active participants.

Preceding the congress, there will be a meeting of the South American Union of Engineering Associations in Sao Paulo from July 9 to 13, to which engineers from other countries are invited.

◆

EJC Survey Shows Down Trend in Employment of 1949 Engineering Graduates

This year's engineering graduates face a 21 percent decrease in employment opportunities from the 1948 level, according to a recent survey conducted by the General Survey Committee of Engineers Joint Council. Returns from some 190 of 500 questionnaires sent out late in January to representative industrial companies and government agencies concerning their 1949 employment programs for engineering graduates indicate that an estimated 8,174 inexperienced engineering graduates will be hired in 1949, a drop of 21 percent from the total of 10,390 hired in 1948. This decline the committee attributes chiefly to the fact that accumulated war and postwar engineering shortages have largely been filled.

Reporting its findings at an EJC meeting, held at ASCE Headquarters on May 9, the General Survey Committee stated that its three main objectives are to gather information annually on the outlook of the engineering profession, its objectives and horizons; to distribute its findings to members of the profession, especially to young men up to middle age, and to employees of engineering personnel; and to provide a single reliable source of this needed information, thus reducing substantially the number of surveys and questionnaires in which employees are being asked to participate.

Organizations reporting to the EJC General Survey Committee include 162 industrial companies and 31 government agencies with over four million employees, of whom more than 89,070 are engineering graduates—over one-quarter of the total number of such graduates in the country. For the industrial organizations, the estimated decrease was almost 26 percent to a total of 5,695; for the government agencies, 8.6 percent to a total of 2,479. Only state government agencies expect an increase in employment. The estimated employment includes 1,065 new chemical or ceramic engineers; 1,951 civil or structural; 1,959 electrical; 2,718 mechanical, aeronautical, or industrial; and 201 mining.

Data on starting salaries indicate that very few companies pay different rates to graduates of different engineering curricula, and only a limited number use geographical differentials. However, significant variations are reported between the rates paid by organizations primarily employing chemical engineers and, to a lesser extent, mechanical engineers and those paid by organizations primarily in the market for electrical or civil engineers. According to the committee, the determining factor in the case is the market rate applying to the major type of engineers sought by the company.

Thus for those employed by concerns seeking mainly chemical or ceramic engineers, a median monthly rate of $290 was reported. For those employed by organizations seeking mechanical, aeronautical, or industrial engineers the median rate was $265, and for those with firms employing mainly civil, electrical, or other engineers it was $250. Average starting salaries reported by organizations, without regard to the numbers of men to be employed, are $255 for graduates at the bachelor level, $300 for those with masters' degrees, and $375 for doctors. Organizations employing principally chemical or ceramic enginers offer highest median rates, which are for bachelors ($275), masters ($310), and doctors ($400), while organizations seeking principally civil and structural engineers offer the lowest median rates—for bachelors $255, masters $275, and doctors $295.

Organizations in the group surveyed report that average monthly increases of $30 will be given by the end of the first year, with 42 percent of them giving the total at one time, 52 percent in two installments, and the remainder in three or four installments. About 50 of the organizations questioned report giving a differential for military service, especially if the individual's military experience is of value to the organization.

A recent upward trend in salaries of engineering graduates with experience is indicated by returns from the 82 organizations responding to a request for data on salaries of engineering graduates ten years out of college late in 1946 and on salaries of those ten years out late in 1948. These organizations report that the median monthly salary for graduates ten years out of college in 1946 was $375, and that for those ten years out in 1948 it was $450, or 20 percent more.

◆

New J. Waldo Smith Fellowship Is Available

The J. Waldo Smith Hydraulic Fellowship is again open to a graduate student who is interested in the advanced study of hydraulics. Two possible subjects for study are proposed by the committee in charge:

1. To determine a practical working relation between diameter of pipe, slope of pipe downward in the direction of flow, slope of hydraulic gradient, average velocity of flow, and possibly other variables, and ability of the velocity to carry air bubbles along and prevent accumulation of air at a high point in the line; also to determine the rate of correction or the degree of certainty with which an increased velocity will entrain and remove the air after it is once accumulated. Lucite pipe is suggested, including a tangent run on the adjustable slope, preferably not less than 10 ft long, and a bend of radius preferably not less than 25 diameters, and long enough to permit a wide range in the adjustment of the tangent slope. The air should be fed into the line on the upgrade ahead of the high point under minimum pressure so as to avoid as much as possible any help from entrainment of the air at the entrance point and so as to simulate a gradual movement of air along the top of the pipe toward the high point. It is desirable to include large diameters, but difficulty in securing and using them may limit the size to 20 in. Preferably, as many as 6 sizes should be used, extending to as little as 4-in. diameter in order to establish the proper relationships.

2. To determine, in the case of a discharge of water through a nozzle into a body of still water, a practical working relation between the size and velocity of the nozzle and the size and form of the stilling pool, and the most efficient form and arrangement of nozzle, etc., to best absorb the energy of the discharge. It is desirable to cover a range of discharges and velocities up to the highest racticable rate allowed by the laboratory equipment. Maximum rates of not less than 20 cfs and 60 fps are desirable.

If applicants wish to submit other projects suitable for hydraulic research, their suggestions will be given due consideration by the committee. Applications should be sent to Society Headquarters before August 1, and the award will be determined around August 15, so that the work itself may start by October 1 and be completed in the regular 1949-1950 academic year.

General terms of the award are described in the 1947 Yearbook (page 137). It will be noted that the fellowship is of joint interest to the graduate student and

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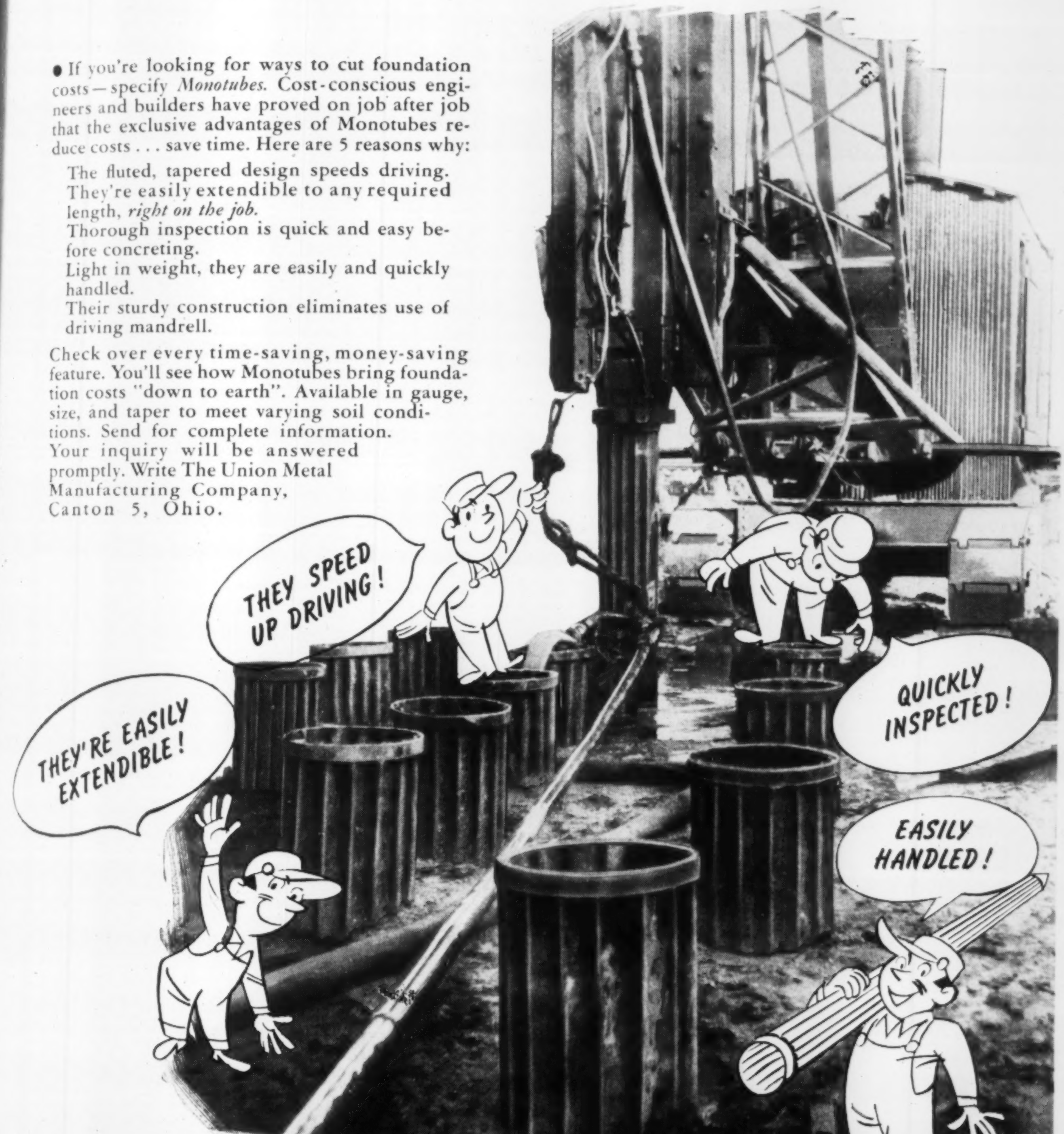
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the institution through which he will work and that the applications will be routed through the institutions themselves. Attention is called to the fact that, for a second year, the monetary allowance for the award is being increased to the amount of $1,000, plus an allowance for equipment up to $400.

◆

TOTAL MEMBERSHIP AS OF MAY 9, 1949	
Members	7,333
Associate Members	9,522
Corporate Members	16,855
Honorary Members	42
Juniors	8,744
Affiliates	72
Fellows	1
Total	25,714
(May 10, 1948	23,336)

NOTES FROM THE *Capital*

JOSEPH H. EHLERS, M. ASCE
Field Representative, ASCE

ALTHOUGH IT IS too early to predict success in retention of the professional employee provisions of the Taft-Hartley Act, it is encouraging to note that they have not been eliminated as yet. The Engineers Joint Council Labor Legislation Panel was confronted with three possible courses of action in the House: Amendment of the Thomas-Lesinski Bill; enactment of the Wood Bill, which included the desired provisions; or presentation of amendments to any other substitute measure which might fail to incorporate them. With House rejection of the Thomas-Lesinski Bill and recommittal of the Wood Bill to committee, final action still is pending. In the Senate, there is reasonable assurance of support for the provisions sought.

Although committee hearings in the House have been held on the bill to establish a National Science Foundation, no bill has as yet been reported out. A similar bill was recently passed by the Senate and further House action is awaited with interest by the engineering and scientific groups interested.

A bill providing for the registering of engineers in the District of Columbia is still in committee with no immediate hearings scheduled.

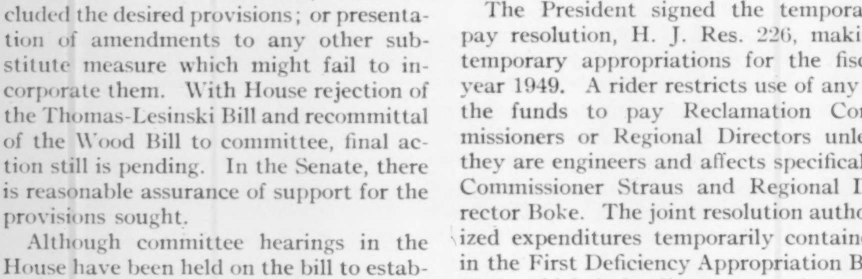
A joker has appeared in the Interior Department appropriation bill which in effect would limit the payment for consultants engaged on a per diem basis of $50 or less in place of the $100 per day limit now permitted in some bureaus.

A bill (S.1722) has recently been introduced in the Senate to authorize the Secretary of the Interior to enter into contracts by negotiation for the services of engineers, engineering associations, or organizations needed in connection with the acquisition or construction of public works.

The President signed the temporary pay resolution, H. J. Res. 226, making temporary appropriations for the fiscal year 1949. A rider restricts use of any of the funds to pay Reclamation Commissioners or Regional Directors unless they are engineers and affects specifically Commissioner Straus and Regional Director Boke. The joint resolution authorized expenditures temporarily contained in the First Deficiency Appropriation Bill 1949, which is in disagreement between the House and Senate.

A series of bills to authorize valley authority operations, particularly in the Columbia Basin, have been presented, following the President's request for approval of a CVA.

The request of the President for an additional $350,000 for water pollution control work by the U.S. Public Health Service, has been turned down by the House.



PUBLICATIONS COMMITTEE IS SEEN AT WORK in Oklahoma City during recent Spring Meeting of Society. Starting at left corner of table, photo shows Sidney T. Harding, Joel D. Justin, Roy W. Crum, chairman, Waldo G. Bowman, Daniel V. Terrell, and Sydney Wilmot, secretary.

NEWS OF LOCAL SECTIONS

Coming Events

Alabama—Summer meeting at the Whitley Hotel, Montgomery, June 24. Registration at 9 a.m.

Duluth—Luncheon meeting at the Kitchi Gammi Club, Duluth, June 20, at 12:15 p.m.

Los Angeles—Annual field day featuring games, entertainment, and dinner at Oakmont Country Club, Glendale, June 21; sports beginning at 4 p.m. and dinner at 6:30 p.m. The Junior Forum is invited to participate in these activities.

Philadelphia—Annual outing and dinner meeting featuring the installation of new officers at Bala Golf Club, Philadelphia, on June 14. Golf starts at 2 p.m. and dinner at 7 p.m.

Rochester—Field trip to Mount Morris Dam combined with a picnic at Letchworth Park, Castile, on June 18, at 1 p.m.

Sacramento—Regular luncheon meetings in the Elks Temple, Sacramento, every Tuesday at 12:30 p.m.

San Francisco—Weekly luncheon meetings held in the Engineers' Club of San Francisco on Wednesday.

Seattle—Meeting at the Engineers' Club, June 15, at 6:15 p.m.; Oregon and Tacoma Sections invited.

South Carolina—Meeting at the Poinsett Hotel, Greenville, on July 22 and 23. Ladies are cordially invited to attend.

Tri-City—Annual social meeting at Watch Tower Inn, Blackhawk Park, Rock Island, Ill., June 11, at 6 p.m.

Asphalt resurfacing
... a modern
magic carpet

ASPHALT resurfacing has proved to be a modern magic carpet for both road-builders and road-travellers. It has helped highway departments and contractors reach new speeds in road-rebuilding. It has provided safe, smooth-riding travel for highway users.

One method of asphalt resurfacing is described below. Standard Oil Asphalt Department Representatives can suggest other types of asphalt construction to meet your needs and local conditions. Write Standard Oil Co. (Ind.), 910 S. Michigan Ave., Chicago 80, Ill.

Steps in one method of Asphalt resurfacing construction

Spot Patching—Where the old highway is badly broken, holes are patched by filling with an asphalt-aggregate mix delivered hot from a central mixing plant.

Prime Coat—This is a thin coat of cut-back asphalt spread over both the old road surface and the patches that have been brushed clean. When used, it helps to bind the asphalt to the old surface.

Binder Course—An asphalt-aggregate mix is delivered hot from the central mixing plant to an asphalt finishing machine and is laid from 2 to 3 inches deep over the old road surface and patches.

Wearing Course—This is the top course composed of asphalt, stone, and sand. It is mixed hot at the central mixing plant and laid by machine. This top course presents a smooth, waterproof, long-wearing surface which requires no seal coat or stone application.

TANDARD OIL COMPANY (INDIANA) STANDARD

Recent Activities

CENTRAL OHIO

VARIOUS ASPECTS OF the design and construction of architectural concrete were summarized in the feature talk at a recent dinner meeting by M. H. Walter, member of the Columbus consulting firm of Alden E. Stilson and Associates. During the business meeting, President C. T. Bowser called attention to pending national legislation affecting the professional employee provisions of the present Taft-Hartley Act and suggested that members write their congressional representatives urging inclusion of these provisions in any new legislation.

COLORADO

SOIL MECHANICS PROBLEMS involved in the construction of ore-storage structures were described by Ralph Peck, research professor in soil mechanics at the University of Illinois, at a recent meeting. After failure of a number of these installations in the Great Lakes area, Professor Peck said, special precautions were taken in design and construction of a large ore-loading field near Cleveland, where it was planned to store ore at a depth of 70 ft. During initial loading of the field, it was discovered that when the depth of ore reached 20 ft, or only about 25 percent of the design load, the plastic clay foundation indicated that failure was imminent. Further investigation revealed that high-pore pressures in the clay had reduced the safety of the structure. The corrective method employed, the speaker said, was to consolidate the clay by increasing loads each year until the design limit could be reached.

DULUTH

AMAZING FACTS CONNECTED with the oil industry were detailed by H. F. Tronnes, of the Standard Oil Co., at a recent meeting. According to Mr. Tronnes, more than $20,000,000,000 is invested in oil fields and refineries, the annual payroll for the industry is more than $4,000,000,000, and $100,000,000 is being spent yearly on research. It has been only 90 years since the first well was drilled, Mr. Tronnes said, and the industry now drills more than 33,000 new wells each year. The daily consumption of petroleum products in the United States is 6,250,000 barrels. A film illustrating the cracking process of refining gasoline supplemented Mr. Tronnes' talk.

GEORGIA

MORE ENGINEERS SHOULD take an active interest in all legislation pertaining to control and development of the state's water resources and stream pollution, Al Stanford, vice-president of Robert & Co., Atlanta engineers and architects, told members attending the May luncheon meeting. Civic improvements of every sort should have the attention of the profession, he stated, pointing out that service on committees and boards is one way to assist in the proper development of municipalities, counties, and states. Mr. Stanford substituted on short notice for the scheduled speaker, A. R. Kelly, head of the department of anthropology and archaeology at the University of Georgia, who was unable to be present.

INDIANA

A PANEL DISCUSSION on research in civil engineering was presented at a recent meeting in Indianapolis by four local engineers and engineering teachers. Lewis B. McCammon spoke on research in the structural field; Prof. C. W. Lawton described the application of photoelasticity to the solution of field problems in civil engineering; G. A. Leonards commented on soil mechanics in its application to the field; and John F. Kinnaman discussed research in industrial waste. Hilden Lacey acted as moderator.

IOWA

ASCE EXECUTIVE SECRETARY William N. Carey attended a recent Section meeting in Des Moines and spoke on the subject, "Engineers and Their Societies." The long and enthusiastic discussion that followed his talk covered the entire range of ASCE activities.

KANSAS

THE ATOMIC ENERGY development program was the subject of the feature talk at a recent dinner meeting at Kansas State College in Manhattan, given by Prof. A. B. Cardwell, of the Kansas State staff. The attendance of over 100 included 60 students, who were introduced to the Section by W. L. Mertz, Student Chapter president.

MARYLAND

GUIDED MISSILES WERE discussed at a recent Section meeting by Maj. Charles D. Y. Ostrom, Jr., assistant to the chief of the Ballistics Measurement Laboratory at the Aberdeen Proving Ground. Major Ostrom described the five classifications of missiles according to use and the operating classification that identifies missiles as ballistic, or short flight (such as shells, bombs, or rockets), and air-borne, which get the lift from the air to the target (aircraft, turbo-jets, and ram jets). Only ballistic types can go outside the atmosphere, he said. Major Ostrom also explained the methods of guidance, and described the optical and electronic instruments used in measuring flight trajectories.

METROPOLITAN

C. B. Molineaux

THE EFFECT OF aerial bombs, underwater detonations, and demolition charges on masonry and earth-filled European dams during the war was detailed at the May meeting by Joseph D. Lewin, civil engineer for the New York Board of Water Supply. Mr. Lewin recently made a tour of European dams, examining and assembling technical details on the extent of damage and the repairs involved. During the business session, the following officers were elected for the coming year: Charles B. Molineaux, president; Henry C. Tammen, vice-president, and Charles E. Trout, treasurer. New directors are Maurice N. Quade, George A. Noren, and Brother B. Austin Barry (first Junior to be elected to the Section directorate). The annual Robert Ridgway Student Chapter Prize Contest will be reported in the July issue.

KANSAS CITY

SOCIETY DIRECTOR David L. Erickson, of Lincoln, Nebr., and Executive Secretary William N. Carey were the principal speakers at a recent meeting of the Kansas City Section. Commenting on the growth of the Society in the past 20 years, Mr. Erickson said that the proportionate enrollment of more Juniors is a step in the right direction. Secretary Carey reviewed the history of the Society and summarized the achievements of EJC in unifying the various branches of engineering and in obtaining legislation beneficial to the profession.

LOS ANGELES

INFORMATION ON THE atomic energy program was given at a recent meeting by Dr. Norris E. Bradbury, director of the Los Alamos Scientific Laboratory, Los Alomos, N. Mex. Dr. Bradbury described progress being made in the field of atomic weapons and peacetime uses of atomic energy, and explained some of the basic principles involved.

At a recent Junior Forum banquet, David Narver, Jr., spoke on his recent construction experiences in Okinawa, and Sig Levin presented a paper he was entering in a competition. The aims and activities of the Forum were outlined by several committee chairmen, Forum past-presidents, and Homer W. Jorgensen, Section Secretary.

LOUISIANA

PRESENT-DAY ENGINEERING graduates are much better equipped to enter the profession than were prewar graduates, according to Maj. Gen. Edward S. Bres,

How Arc Welding Simplifies Beam-To-Column Connections

MODERN welded buildings are being erected in less time and at lower cost with arc welding. Structural members are designed to permit fast shop fabrication wherever possible. For erection, columns, girders and beams are aligned, bolted, guyed and then arc welded with Lincoln "Fleetweld 5" electrodes using Lincoln Engine Driven "Shield-Arc" DC welders. The following examples of beam-to-column framing are typical of structural connections being used on multiple story buildings in various parts of the country and are discussed in detail in a new series of Structural Studies, available from The Lincoln Electric Company.

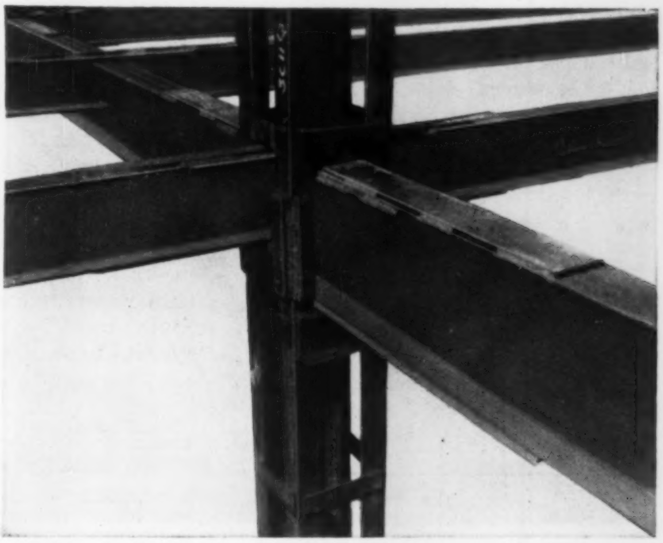


Fig. 1. Main girders, supported on cross channel plates, run directly through main columns. Four column angle sections shown are for temporary support during erection and later serve for composite steel and concrete columns. This construction is used on a Los Angeles Bell Telephone Building extension.

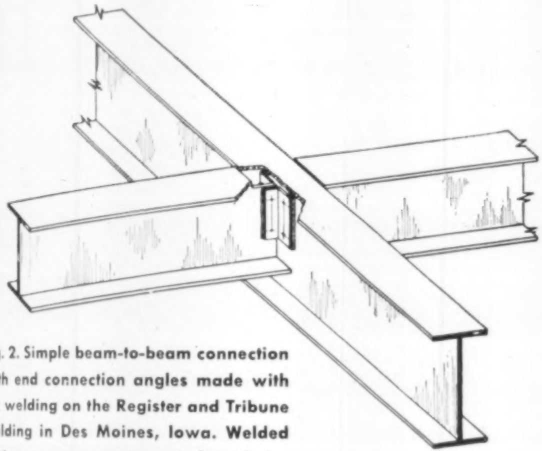


Fig. 2. Simple beam-to-beam connection with end connection angles made with arc welding on the Register and Tribune Building in Des Moines, Iowa. Welded design assures exact span length for beams and exact spacing of main girders.

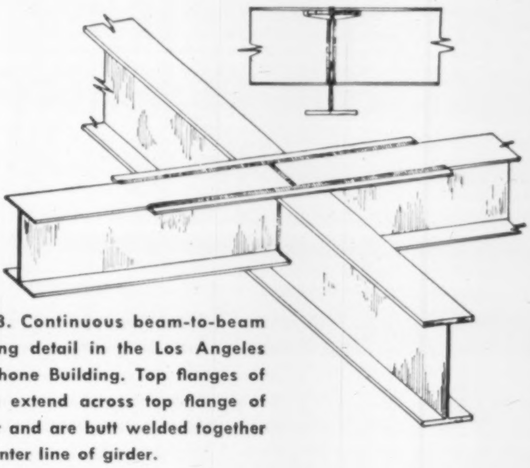


Fig. 3. Continuous beam-to-beam framing detail in the Los Angeles Telephone Building. Top flanges of beam extend across top flange of girder and are butt welded together on center line of girder.

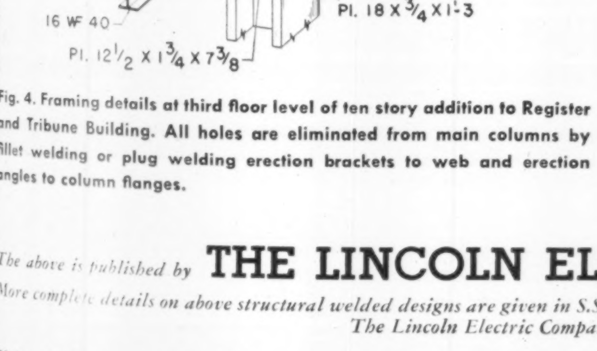


Fig. 4. Framing details at third floor level of ten story addition to Register and Tribune Building. All holes are eliminated from main columns by fillet welding or plug welding erection brackets to web and erection angles to column flanges.

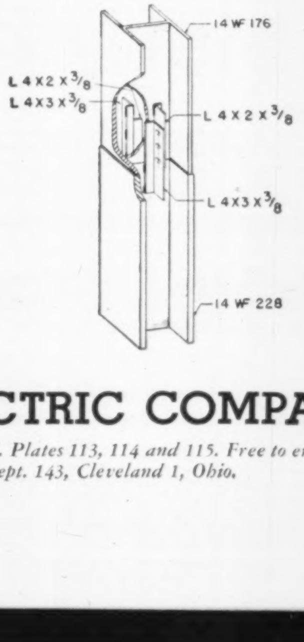


Fig. 5. Column splice at third floor level uses splice angles shop-welded to column webs. During erection, angles serve to hold columns in alignment while field-welding. Column ends are milled square in the shop and edges bevelled for simpler field-welding.

The above is published by **THE LINCOLN ELECTRIC COMPANY** *in the interests of progress.*

More complete details on above structural welded designs are given in S.S.A.W. Plates 113, 114 and 115. Free to engineers. Write on your letterhead to The Lincoln Electric Company, Dept. 143, Cleveland 1, Ohio.

secretary of the Army Personnel Board. Speaking on engineering in the postwar period at a joint meeting of the Section and the Tulane University Student Chapter, General Bres attributed this difference to the maturity of today's graduates, many of whom are veterans. In the war services, he said, these veterans had the kind of engineering training that would, in normal times, take years to acquire. Their experience has enabled them to know what branch of the profession they prefer, and their mature status helps them get more out of college than the average student, he stated.

MIAMI

ASCE Director Edmund Friedman attended the Section's May luncheon meeting and reported on the Society's Spring Meeting in Oklahoma City, commenting particularly on proposed plans for reducing the budget. The remainder of the afternoon was devoted to inspection of the Miami International Airport and the repair, overhaul, and engine test plants of Pan American World Airways. J. J. Dysart, general manager of maintenance for the company, conducted the tour. The principal speaker at another recent meeting was Dr. Reinhold P. Wolff, of the economics department of the University of Miami, who talked on the population rise in southeast Florida and Dade County since the last census.

NASHVILLE

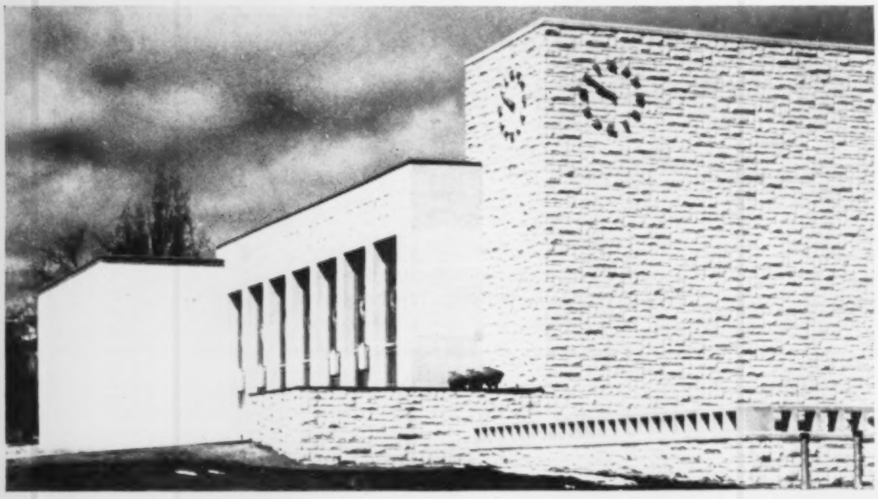
Methods of determining bridge stresses by the use of electromagnetic strain gages were described at a joint meeting with the Vanderbilt University Student Chapter by E. J. Ruble, research bridge engineer for the American Association of Railroads. A colored movie of the equipment used in such tests supplemented Mr. Ruble's talk, and R. W Mabe described the Bridgeport, Ala Railroad Bridge, tested by the method.

PHILADELPHIA

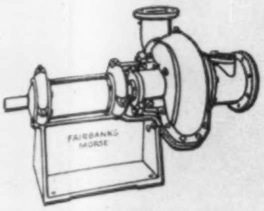
In a talk on "Design Considerations for Modern Railroad Cars," presented a the May meeting of the Philadelphia Section, James J. Silimeo, stress analyst for the Budd Co., Philadelphia, discussed the stainless steel streamliners developed by his company. The other leading speaker, Richard Weston, Jr., design and cost estimator for Hungerford & Terry Inc., explained the many factors affecting the palatability and chemical safety o water and compared the differences i treatment requirements for public drinking supply and commercial and industrial uses. The entire meeting was under the sponsorship of the Junior Forum, and Forum activities and plans for the future were outlined by Chairman Padlasky.

NEW MEXICO SECTION

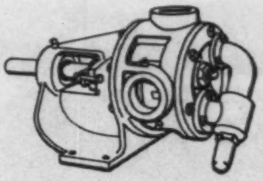
More than 80 engineers from all over New Mexico attended a recent Section meeting that featured inspection of Los Alamos. Guests included Executive Secretary William N. Carey and former Society officers, Arthur W. Harrington and Fred C. Scobey. Short orientation talks, preceding a two-hour tour of the atomic city, were given by Earle D. Sullivan, assistant manager for community affairs, who outlined the history of the project and future plans for the city; R. E. Cole, of the Santa Fe Operations Office of the Atomic Energy Commission, who explained the engineering organization of the AEC at Los Alamos; Frank Highleyman, engineer with Black & Veatch, who told of the problem of supplying water to the fast-growing town and Richard Crook, city engineer for the Zia Co., who outlined the widespread organization for town maintenance under his direction. Projects currently under construction were described by D. J Bandy, of the Robert E. McKee Co., and James W. Savage, of W. C. Kruger and Associates; and Walter Gay, of the University of New Mexico, reported on the current research in the use of pumice aggregate that is being conducted under contract with the AEC. The tour of Los Alamos included stops at various construction projects and a guided trip through the enormous hangar housing the mechanical maintenance facilities Colonel Carey, main speaker of the evening dinner meeting, stressed the budget problems of the Society, and described the role of EJC in unifying and advancing the profession. Local arrangements were handled by Don Johnstone Leonard V. Koch, Richard Crook, Burton Smith, Jose A. Trujillo, W. H. Gilliard G. R. Hawthorne, and Russ Foster.



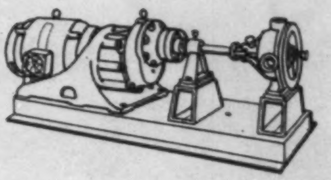
CIVIL ENGINEERS VISIT LOS ALAMOS on recent inspection trip sponsored by New Mexico Section. Upper photo shows nearly completed first class post office, part of $4,000,000 community center being built in atomic city. Photo through courtesy of John Moore, A. E Security Service, Los Alamos.



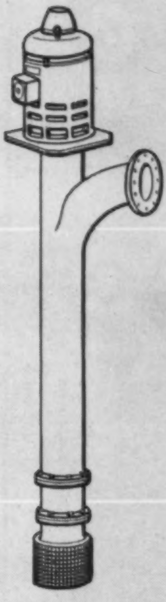
Paper Stack Pumps



Frame Constructed Rotary Pumps

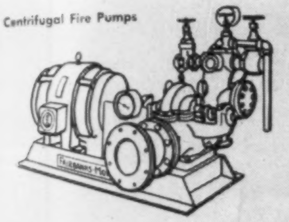


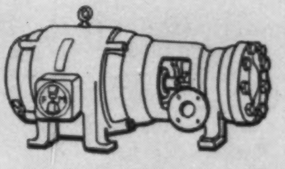
Rotary Pumps with Geared Head Motor Drive



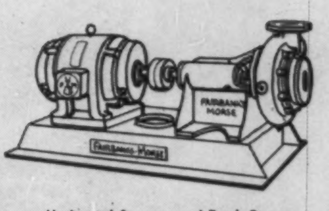
Vertical Propeller Pumps

Centrifugal Fire Pumps

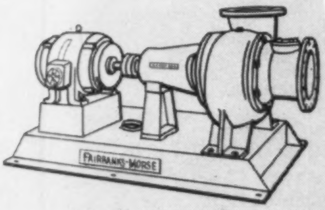




Two-Stage Builtogether Pumps

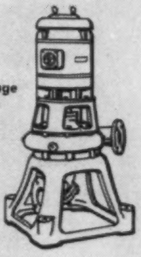


Horizontal Sewage and Trash Pumps

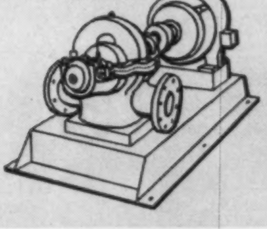


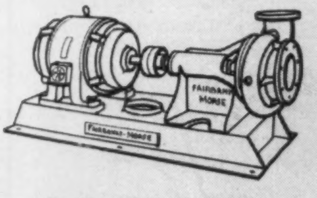
Horizontal Angle Flow Pumps

Vertical Close-Coupled Sewage and Trash Pumps

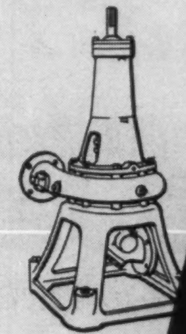


Split-Case Centrifugal Pumps



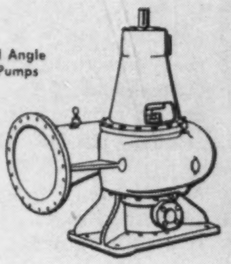


Base-Mounted Centrifugal Pumps



Vertical Sewage and Trash Pumps

Vertical Angle Flow Pumps



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lasting dependability
unsurpassed economy

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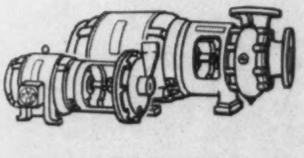
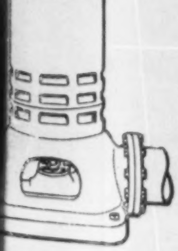
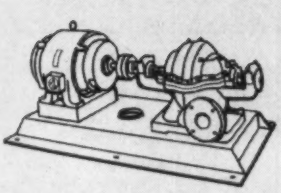


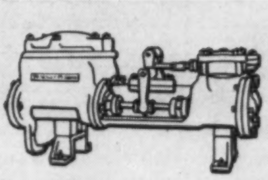
Builtogether Centrifugal Pumps



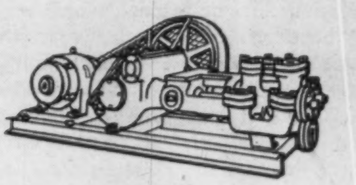
p Well Turbine Pumps



Two-Stage Centrifugal Pumps



Duplex Steam Pumps



8 Cover Side-Pot Duplex Power Pumps

ROCHESTER

Rochester's water supply problems, including the need for developing additional sources, were reviewed at a recent dinner meeting by P. A. Covas, engineer for the Rochester Department of Public Works. Mr. Covas' conclusion was that, in spite of recommendations to develop upland supplies, no action should be taken in such a direction without fully exploring Lake Ontario sources first.

SACRAMENTO

Foundation problems that must be solved before the proposed San Francisco Bay crossings can be built were explained, with the aid of profiles, at a recent Section meeting by Parker Trask, chief engineering geologist for the Bay Toll Crossings. Methods of education used in the new Institute of Transportation and Traffic Engineering at the University of California were described at another meeting by Prof. Harmer E. Davis, acting director of the Institute. Other recent luncheon speakers include H. V. Lutge, of the Pacific Gas & Electric Co., and William I. Gardner, chief geologist for the U.S. Bureau of Reclamation.

SAN DIEGO

Development of the Imperial Valley Irrigation System was outlined by Burrage Weiss, executive engineer for the Imperial Irrigation District, at a recent meeting. Mr. Weiss described early attempts to irrigate the region through formation of the present Imperial Irrigation District in 1911. Today the District employs over 1,000 people, serves a 400,000-acre area, and has assets of about $50,000,000 he said. Problems currently facing the District include drainage of the area, which is below sea level, and expansion of its power-generating facilities, which are behind the power demand.

SEATTLE

The Army Corps of Engineers "308 Report" on the development of the Columbia River was discussed at a recent meeting of the Section by Bertram P. Thomas and Sherman Green, both of the staff of the Seattle District. Both speakers stressed the cooperation achieved among various government agencies in preparing the report, and the detailed studies of hundred of dam sites that went into the work. Present recommendations for the project, which would cost between three and five billion dollars, call for the construction of multiple-purpose dams (John Day, Priest Rapids, and the Dalles) on the Columbia; Hell's Canyon on the Snake River; Alberni Falls on the Pend Oreille River; Libby Dam on the Kootenai River; and Glacier View on the Flathead River. These projects would require 20 years.

SAN FRANCISCO

A symposium on highway traffic problems from the engineering point of view was presented at a recent meeting by University of California Professors Harmer E. Davis and Donald S. Berry, acting directors of the newly created Institute of Transportation and Traffic Engineering there. Professor Davis stressed the importance of highway transportation to the California economy and listed the immediate needs of the state "in combatting highway strangulation." Professor Berry noted the growth of traffic engineering and its emergence as a separate engineering field, its chief functions being to provide the public with additional safety and traffic capacity. A first-hand account of the damage caused by the recent earthquake in the Pacific Northwest was given by H. J. Brunnier, consulting structural engineer.

SOUTHERN IDAHO

Improvement in engineer-contractor relationships was the theme of a panel discussion highlighting a recent meeting. The problems confronting the engineer, contractor, lawyer, and cost accountant were detailed, in turn, by George N. Carter, district manager for the Bureau of Reclamation; N. L. Terteling, of J. A. Terteling & Sons, general contractors; J. F. Cromwell, Boise attorney; and Otto Nielsen, assistant comptroller for the Morrison-Knudsen Co. Discussion emphasized the point that improvement in engineer-contractor relations would reduce construction costs and improve the quality of the work performed.

WISCONSIN

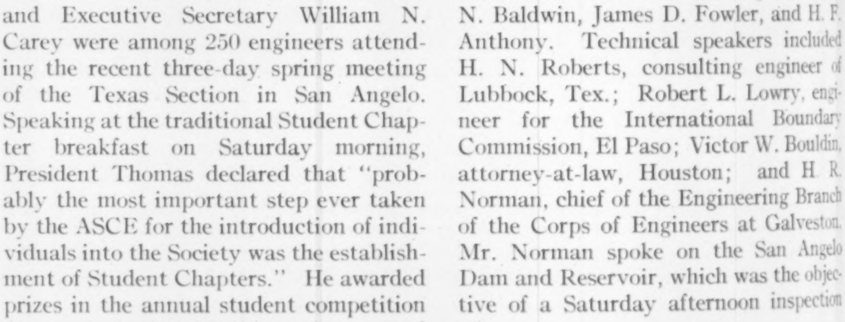
Large-scale earthmoving operations, recently started in the Mesabi Range country of northern Minnesota, were discussed at a recent dinner meeting by W. L. Bradshaw, district manager of the Jeffrey Manufacturing Co. Mr. Bradshaw illustrated his talk with a color film, demonstrating the use of a unique system of equipment to remove the 200-ft overburden and of other large construction equipment.

WYOMING

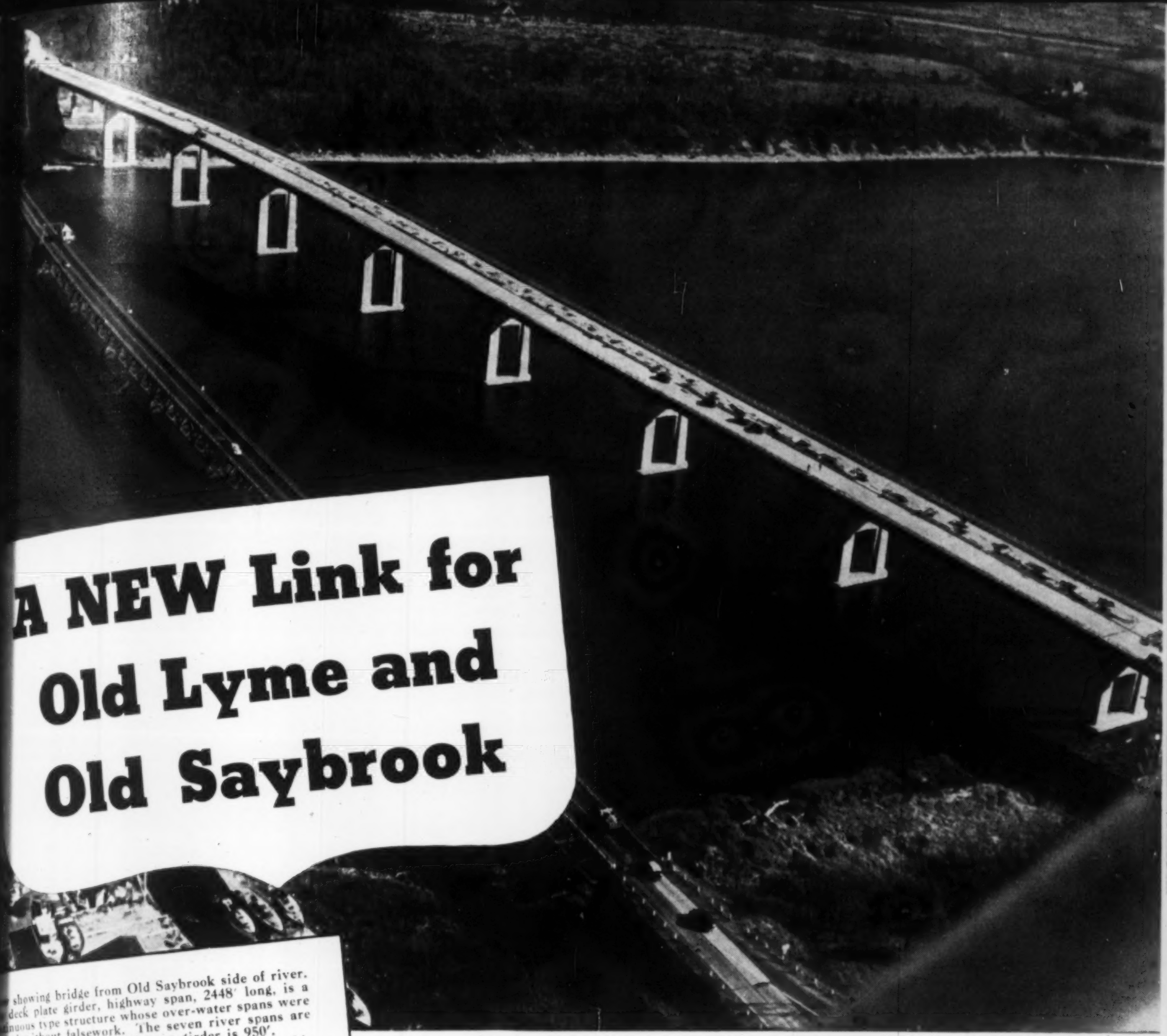
Negotiations just completed in connection with the Upper Colorado River Basin Compact were outlined at a recent meeting by R. D. Goodrich, who recently retired as dean of the College of Engineering at the University of Wyoming. Mr. Goodrich was then presented with a certificate of life membership by his successor to the deanship, H. T. Person.

TEXAS SECTION

ASCE President Franklin Thomas and Executive Secretary William N. Carey were among 250 engineers attending the recent three-day spring meeting of the Texas Section in San Angelo. Speaking at the traditional Student Chapter breakfast on Saturday morning, President Thomas declared that "probably the most important step ever taken by the ASCE for the introduction of individuals into the Society was the establishment of Student Chapters." He awarded prizes in the annual student competition (see page 56 for details), and presented certificates of life membership to Frank N. Baldwin, James D. Fowler, and H. F. Anthony. Technical speakers included H. N. Roberts, consulting engineer of Lubbock, Tex.; Robert L. Lowry, engineer for the International Boundary Commission, El Paso; Victor W. Bouldin, attorney-at-law, Houston; and H. R. Norman, chief of the Engineering Branch of the Corps of Engineers at Galveston. Mr. Norman spoke on the San Angelo Dam and Reservoir, which was the objective of a Saturday afternoon inspection trip.



BOARD OF DIRECTORS OF TEXAS SECTION, in attendance at Section's recent spring meeting in San Angelo, is photographed with President Franklin Thomas and Executive Secretary William N. Carey. Shown, left to right, are: P. M. Ferguson, vice-president, Austin; H. N. Norman, vice-president, Galveston, President Thomas; W. E. Simpson, president, San Antonio; Secretary Carey; I. W. Santry, Jr., secretary-treasurer, Dallas; and Conrad Blucher, director, Corpus Christi. H. R. F. Helland, director, San Antonio, was unable to attend.



A NEW Link for Old Lyme and Old Saybrook

showing bridge from Old Saybrook side of river.
deck plate girder, highway span, 2448′ long, is a
nuous type structure whose over-water spans were
ed without falsework. The seven river spans are
long. The longest continuous girder is 950′.
Over 6000 tons of structural steel went into this
ge which carries two 24′ roadways, separated by
enter mall and flanked by two 3′ sidewalks. U·S·S
eam-Lok was used for the gutters, center mall and
ncrete filled) sidewalks. (Old bridge with bascule
n which new bridge replaces shown at left.)

Progress photo showing American Bridge crews erect-
98-ton girders by use of traveling derrick and der-
k boat.
signed by: Connecticut State Highway Department.
nsultants to Bridge Commission:
ward, Needles, Tammen & Bergendoff

FABRICATED AND ERECTED BY AMERICAN BRIDGE

THE Raymond E. Baldwin Bridge provides an important link carrying U. S. 1 over the Connecticut River between Old Lyme and Old Saybrook, Conn.

The superstructure for this monumental $6,500,000 bridge was fabricated and erected for the State of Connecticut by American Bridge Company. In addition, American Bridge furnished the concrete roadways, sidewalks, gutters and center mall.

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USS

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NEWS BRIEFS

Construction Activity for First Quarter of 1949 Exceeds 1948 Total for Period

All new construction activity for the first quarter of 1949 amounted to $3.5 billion, a 5 percent rise above the total for the corresponding period in 1948, according to a recent Department of Commerce Industry Report. This increase, however, is considerably smaller than that recorded between the opening quarters of 1947 and 1948. The volume of new housing units started, of construction contracts awarded, and of building materials produced, shipped and sold during the first three months of 1949 were below the levels attained in the same period last year.

Gains for the period are attributed primarily to the expansion of publicly financed construction, which totaled $855 million, a 41 percent increase over the 1948 first-quarter total of $607 million. In the same period privately financed construction, valued at $2,653 million, declined 3 percent, with moderate gains in nonresidential and public utility building offset by slightly steeper drops in residential and farm construction.

New construction put in place during March, valued at $1.2 billion, showed a slightly more than seasonal rise of $100 million, or 9 percent, from the revised February total, and was $30 million above the construction total for March 1948. Privately financed new construction, amounting to $881 million, accounted for almost three-quarters of the March total. Privately financed residential construction put in place, exclusive of farm building, was valued at $400 million, an increase of 7 percent from the revised February figure. The value of privately financed nonresidential building was $266 million, a drop of 4 percent from the previous month. Public utilities (privately financed) spent $197 million, 12 percent more than in January.

Total public construction for the month was valued at $314 million, an increase of 24 percent over the February total. Types of public construction showing more than the usual seasonal increase from February to March included highway, sewer and water installations.

Despite the fact that construction costs continued to decline during February (0.2 of 1 percent from January), average construction costs for the month were 5.1 percent above those in February 1948, according to the Department of Commerce Composite Index of Construction Costs. At the same time, wholesale prices of building materials in February fell 0.4 of 1 percent below their January levels, according to the Bureau of Labor Statistics.

Measured on an over-all basis, production of building materials during February declined 7 percent below the January level—a somewhat steeper drop than the usual seasonal decline between the two months. Production of all but three (plywood, warm air furnaces, and structural tile) of 20 materials on the Department of Commerce Composite Index declined during February. These declines, following decreases recorded in January, brought the over-all Index for the first two months of 1949 to a point 11 percent below that for the corresponding period of 1948.

◆

Port Authority Offers New Plan to Improve N.Y. Waterfront

A $91,000,000 program for developing and operating municipally owned waterfront facilities under the terms of a 50-year lease has been proposed by the Port of New York Authority. This proposal, which has been transmitted to the mayor for study, is a revision of the Authority's $114,000,000 pier program (Civil Engineering for April 1948, page 58) furnished to the city in February 1948 and rejected by the Board of Estimate later in the year.

The physical plan of the new proposal differs from that of the original Port Authority program principally in that it abandons for the time being plans to construct a $34,500,000 combination union produce terminal and railroad carfloat station in downtown Manhattan. Uncertainties resulting from a recent attempt on the part of railroads to increase charges for deliveries of produce requiring unloading from carfloats are responsible for shelving plans for the produce terminal and carfloat station at present.

In addition to carrying out its original proposal to construct six new steamship piers, designed to handle modern vessels and equipment efficiently without freight or truck congestion, and three union railroad carfloat stations, the Authority under its new offer would reconstruct the burned-out Pier 57 in the North River. The present plan also retains original proposals for modernization and rehabilitation of 14 existing North River piers and for complete rehabilitation of 54 additional piers, with provision for fire protection. Pointing out that a recent sharp rise in insurance rates on unprotected piers makes imperative a protection program, the Authority proposes a $5,500,000 fire-prevention program, designed to effect a reduction of at least $1,000,000 a year in insurance costs.

In computing its costs under the new plan, the Authority takes into account an 8 percent rise in construction costs during the past year.

◆

Rise in Construction Work East of Rockies Is Noted

Construction contracts awarded in the 37 states east of the Rocky Mountains in April amounted to $842,586,000, a 13 percent gain over March, but a decline of 4 percent from the total for April 1948, according to the F. W. Dodge Corp., fact-finding organization for the construction industry. Increased investment commitments are reported in commercial, educational, hospital, institutional, and recreational building and in single-family houses built to owners' orders for their own occupancy, with totals in these groups higher than those for March of this year and for April of last year. Awards for public works were also in the ascendency during the month.

Despite these gains in construction volume, the cumulative record for the first four months of the year in all building and engineering classifications showed a total of $2,641,656,000, which is 8 percent less than the total reported for the first four months of 1948. The drop for the first four months results from an over-all decline of 1 percent in nonresidential construction to a total of $1,087,589,000; a drop of 17 percent in residential awards to a total of $907,796,000; and a decrease of 3 percent in public works and public utilities awards to a total of $646,271,000.

◆

Houston, Tex., to Enlarge Its Sewage Treatment Plant

Expansion of the North Side Sewage Treatment Plant at Houston, Tex., to increase its capacity from 18 to 30 mgd, recently got under way with the award of a $1,041,081 construction contract to the Rust Engineering Co., of Birmingham, Ala. The contract, largest ever made by the City of Houston, also includes building a fertilizer plant to take care of sludge from the North Side and the Sims Bayou treatment plants.

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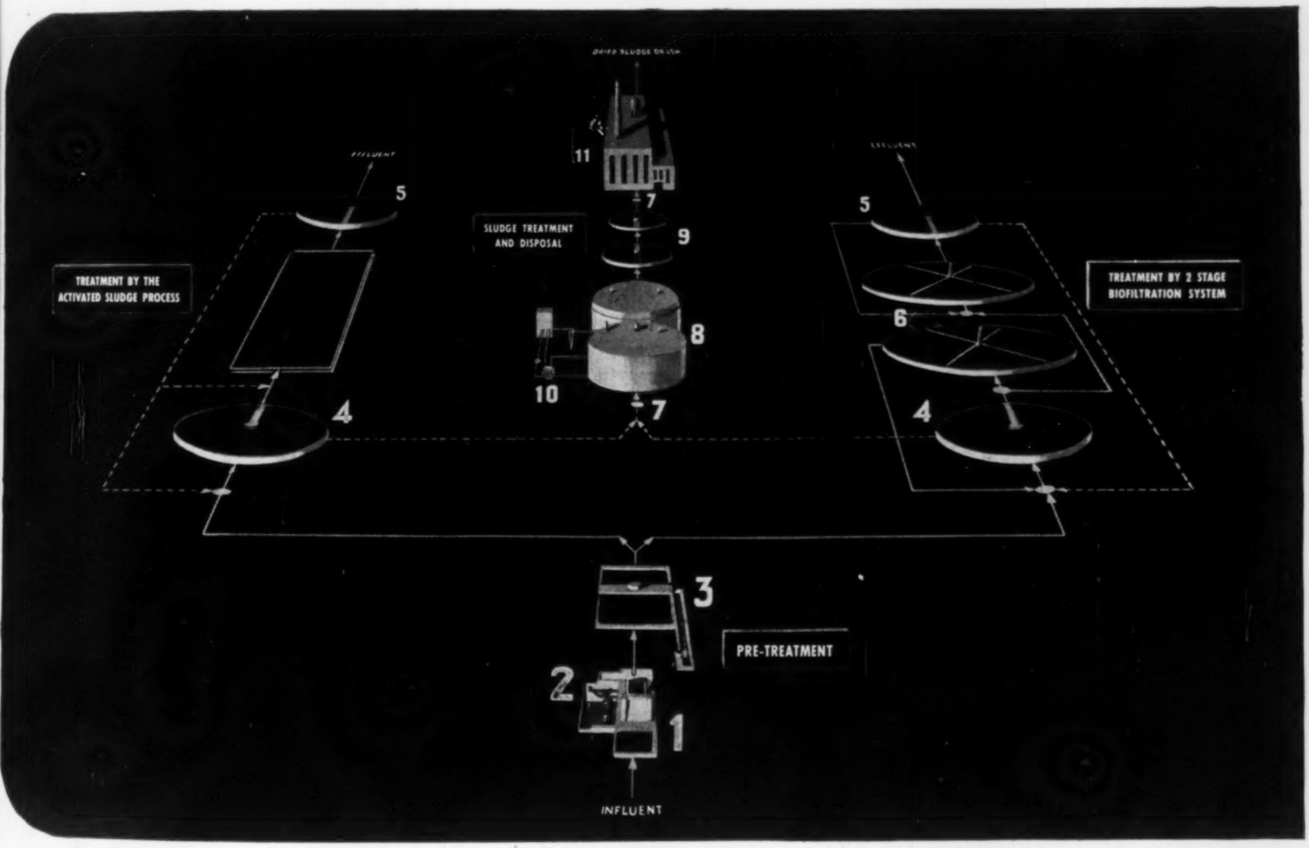
(for grit, scum and solids removal)

* Alternative or combination units not shown on composite drawing.


DRIED SLUDGE OR ASH
11
EFFLUENT
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SLUDGE TREATMENT AND DISPOSAL
9
EFFLUENT
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TREATMENT BY THE ACTIVATED SLUDGE PROCESS
TREATMENT BY 2 STAGE BIOFILTRATION SYSTEM
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2
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RESEARCH ■ ENGINEERING ■ EQUIPMENT

Mexican Technical Advances Noted at Engineering Congress

MEXICAN ENGINEERS ARE doing extraordinary work in urban construction, according to Mario G. Salvadori, Assoc. M. ASCE, associate professor of civil engineering at Columbia University and an ASCE delegate to the First International Congress of Civil Engineers, held in Mexico City early in May. "They are erecting buildings as high as 17 stories on the worst soil existing in any capital in the world," Professor Salvadori said in a report on the Congress submitted to Society Headquarters. Visits to water works, dams, harbors, railroads, and other engineering projects also "impressed the American engineers with the tremendous construction effort being made by their Mexican colleagues to transform their country into a modern industrial nation," he stated.

As many as eleven sections of the Congress held technical sessions concurrently during the eight-day meeting, Professor Salvadori reported. In all, 200 papers were presented by approximately 1,000 delegates from 21 American republics and four European countries. The ASCE delegation in Mexico City was headed by Honorary Member Andrew Weiss. Howard Peckworth, M. ASCE, also represented ASCE at the Congress. Rivero del Val, chairman of the Organizing Committee, presided during the Congress, and Nabor Carrillo was honorary vice-president. During the closing session, a resolution was passed to hold a Second International Congress of Civil Engineers in 1953.

The Congress took place on the campus of the Colegio de Ingenieros Civiles de Mexico, one of the sponsoring organizations. Other sponsors included Señor Miguel Aleman, president of Mexico, the Association of Engineers and Architects of Mexico, the University of Mexico, and the National Polytechnic Institute.

◆

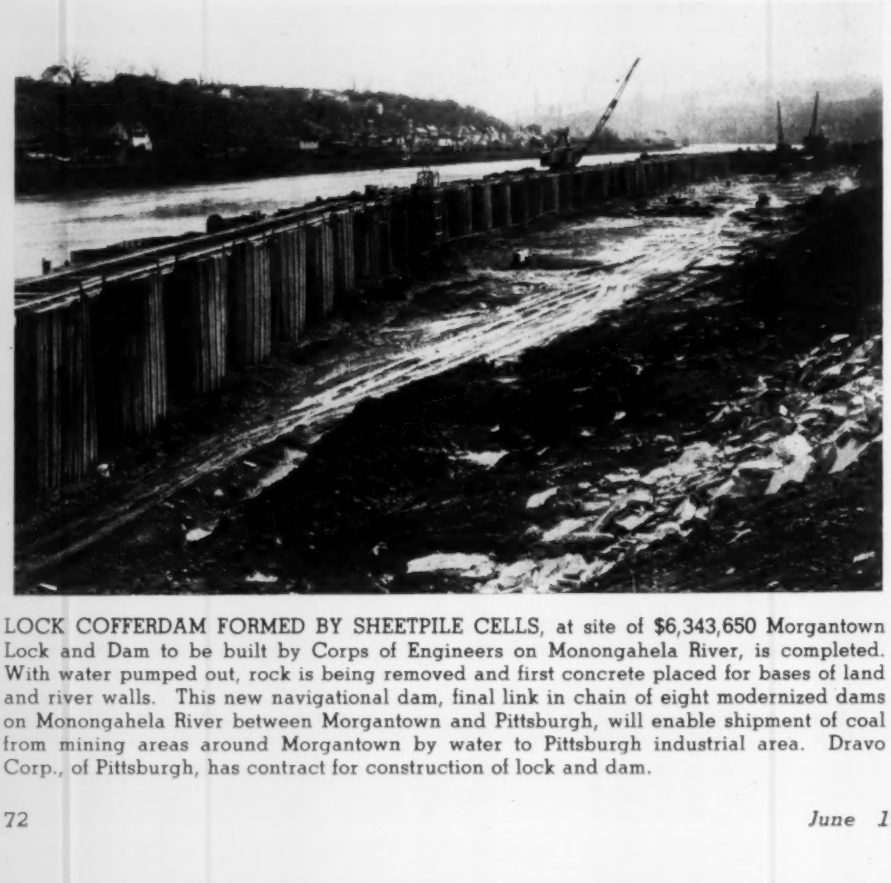
Production of Building Materials Reaches Peak

SHORTAGES OF BUILDING materials and equipment have disappeared in the face of a two-year period of record-breaking production, according to a recent release of the Producers' Council. "With distribution of materials returning to its prewar pattern, deliveries of virtually all products used in construction can be obtained on reasonably short notice."

Though retail dealers' inventories are, on the average, still somewhat below the levels maintained before the war, delays in construction due to late arrival of materials are a thing of the past, according to the Council. "It no longer is necessary for builders or contractors to use substitute materials, and there is a wider selection of products available for any type of building than at any time in the past.

"Production of building materials and equipment reached its all-time peak in October 1948, when it was 61 percent above the 1939 average and 20 percent greater than the previous peak attained in 1925."

Work Progresses on New Corps of Engineers Dam on Monongahela



LOCK COFFERDAM FORMED BY SHEETPILE CELLS, at site of $6,343,650 Morgantown Lock and Dam to be built by Corps of Engineers on Monongahela River, is completed. With water pumped out, rock is being removed and first concrete placed for bases of land and river walls. This new navigational dam, final link in chain of eight modernized dams on Monongahela River between Morgantown and Pittsburgh, will enable shipment of coal from mining areas around Morgantown by water to Pittsburgh industrial area. Dravo Corp., of Pittsburgh, has contract for construction of lock and dam.

R. E. Dougherty to Serve on White House Renovation

PRESIDENT TRUMAN HAS named ASCE Past-President R. E. Dougherty, of New York, and Douglas W. Orr, past-president of the American Institute of Architects, to the recently authorized six-man commission on rebuilding of the White House. Other members of the commission, created by Congress in April with passage of Public Law 40, will be two Senators and two Representatives.

R. E. Dougherty

The act gives the new commission authority to approve all construction plans for renovation and modernization; approve the selection of contractors and subcontractors; and supervise the progress of the work. Messrs. Dougherty and Orr have been serving since last summer on a committee appointed to study the elimination of structural and fire hazards in the White House.

◆

1948 Construction in Cities Reaches 21-Year High

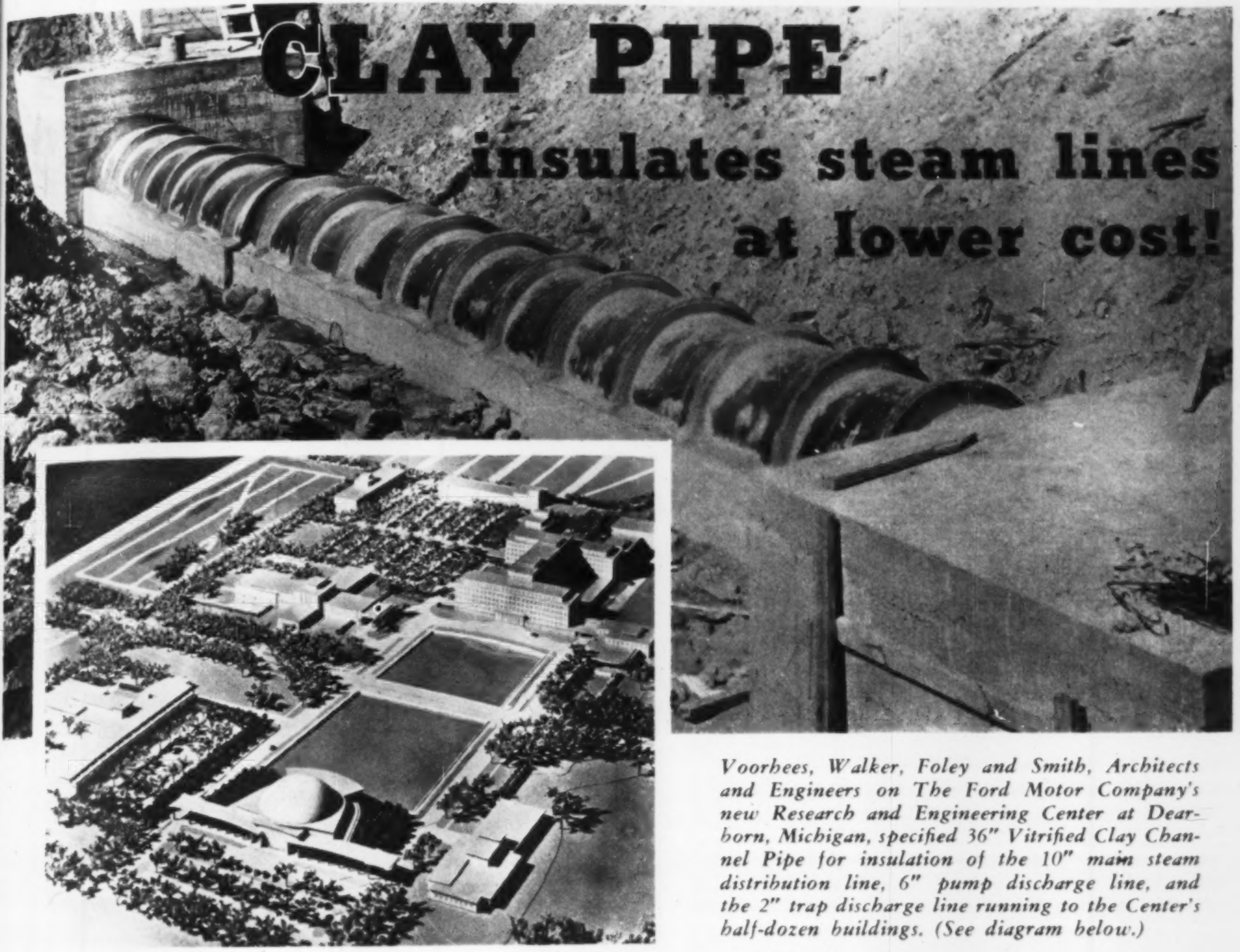
CITY BUILDING CONSTRUCTION in the United States in 1948, as measured by building permits issued and federal contracts awarded, was valued at $7,000,000,000, a 25 percent increase over 1947 and the highest recorded value since 1927, according to a Bureau of Labor Statistics estimate reported in a recent bulletin of the Department of Labor. Data given do not include the work done in small towns or unincorporated areas on the outskirts of large industrial and metropolitan centers.

The dollar volume jumped 73 percent from the February low of $414,000,000 to the April peak of $715,000,000 close to the March 1946 all-time monthly record. Thereafter, permit valuations remained at a $650- to $700-million level through August, followed by seasonal declines to $424,000,000 in December. The 1948 peak was 18 percent above the 1947 high reached in October.

Three-fifths of the total value of 1948 urban building authorized was centered in three regions: the East North Central ($1,426,000,000), the Pacific ($1,414,000,000), and the Middle Atlantic ($1,190,000,000). The Pacific States ranked first in residential valuations, while the East North Central States led in non-residential building.

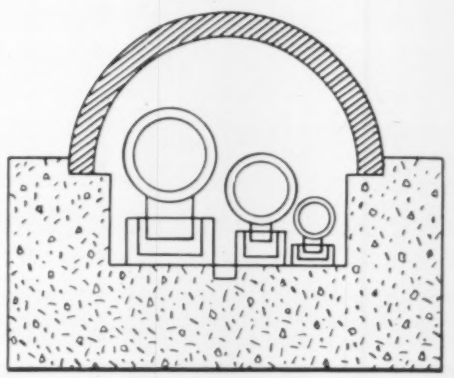
California, with permit valuations totaling more than a billion dollars in 1948, has outstripped all other states in dollar volume of city building since 1942—the earliest year for which the Bureau has state data. New York and Texas, each with a half a billion dollars of construction authorized, ranked second and third, respectively. Los Angeles, New York, Chicago, and Detroit were the top cities in construction in 1948.

CLAY PIPE insulates steam lines at lower cost!



Voorhees, Walker, Foley and Smith, Architects and Engineers on The Ford Motor Company's new Research and Engineering Center at Dearborn, Michigan, specified 36" Vitrified Clay Channel Pipe for insulation of the 10" main steam distribution line, 6" pump discharge line, and the 2" trap discharge line running to the Center's half-dozen buildings. (See diagram below.)

ENGINEERS of The Ford Motor Company knew what they were doing when they installed Clay Pipe, not only in waste disposal lines of this huge, 50-million-dollar project, but also used Clay Channel Pipe for long-lasting, efficient insulation for the Center's more than 1,600 feet of underground steam lines! With a keen eye on speedy, easy construction at low cost, they knew they could build up their own steam line insulation with Clay Channel Pipe as the outside cover, and save time and money on the job. Why not get the facts from us and use the same construction on your job?



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300 Mile Modern Highway to Traverse Venezuela

Construction of a $6,000,000 network of modern highways in Estado Sucre, Venezuela, recently inaugurated by the governor of the state, will connect Cumana, state capital and seaport, with the oil fields of eastern Venezuela. The contract for the project, calling for construction of 300 miles of asphalt-paved roads, 22 bridges, and numerous culverts, has been given to Equipos, S.A., large Venezuelan road-building firm.

◆

Steel Output for April Sets Record for Month

With production of 7,783,807 tons of raw steel in April, the steel industry established a record for that month, despite the fact that operations averaged less than 100 percent of capacity for the first time this year, according to the American Iron and Steel Institute. Steel-making furnaces were operated at 98.4 percent of capacity in April, compared with the record rate of 102.7 percent of theoretical capacity established in March. However, the average weekly production of 1,814,407 tons during the month remained higher than the average weekly output in any month prior to this year, with the exception of November 1948.

Another record was established with the production of 31,835,953 tons of ingots and steel for castings in the first four months of this year, an increase of 3,600,000 tons, or 12.6 percent, over the corresponding period in 1948.

◆

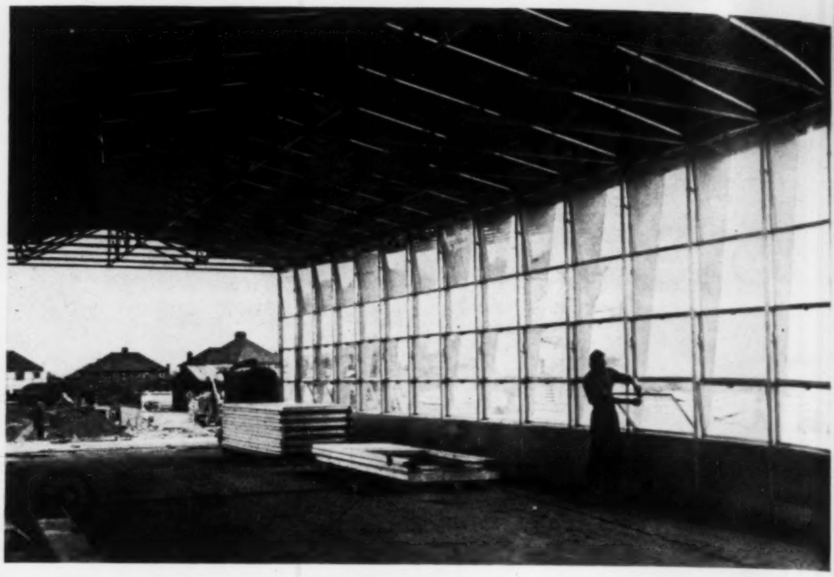
Highway Departments to Test Rubber Pavements

Tests in the use of powdered natural rubber mixed with asphalt to improve road surfacing will soon be undertaken by the state highway departments of Texas, Virginia, and Ohio, in cooperation with the Rubber Development Bureau, Washington, D.C., a subsidiary of the British Rubber Development Board. Rubber powder for the test installations will be supplied by the Dutch Rubber Foundation, which has sent its director general, R. Houwink, to the United States to aid in making the tests.

Advantages claimed for the method include reduction in maintenance costs, longer life for the road surface, better protection for foundation materials, non-skid features, and a smoother, more water-resistant and dust-free road surface. In the Netherlands test sections of pavement incorporating the powdered rubber are still in good condition after more than a decade of hard use in peace and war, according to Dr. Houwink, who states that such surfaces have stood up much better under traffic than adjoining areas without rubber admixture.

Use of from one-third to one ton of powdered rubber per mile of surfacing is recommended.

Aluminum Schools Avoid Building-Supply Bottleneck in Great Britain



EXPERIMENTS IN BUILDING OF PREFABRICATED ALUMINUM SCHOOLS are being made in Britain to avoid use of building materials that are in short supply. Such buildings need not conform to standard pattern, as aluminum units can be put together in a variety of ways and used as additions to existing schools. Construction requires only few weeks. Photo shows interior of main classroom of aluminum school under construction at St. Paul's Cray, Orphington, Kent. When completed, it will be divided into six different classrooms.

FWA Reports Construction Program Outside Continent

Recent construction programs administered by the Bureau of Community facilities of the Federal Works Agency in the Virgin Islands, Hawaii, and Alaska, are reviewed by George Field, commissioner of the Bureau, in a recent issue of *Public Construction*, monthly publication of the FWA.

Stating that a large part of the Bureau's work in the Virgin Islands has been concerned with the difficult task of obtaining an adequate supply of fresh water, Mr. Field points out that novel engineering techniques are being used to cope with the problem. Work going forward at present includes construction of a flight strip to divert rainwater into underground catchment basins to provide adequate drinking water for the Island of St. Thomas, seat of the insular government. Another plan to obtain potable water involves the installation of a solar distillation system on the Island of St. John which will permit the use of ocean water. A Massachusetts Institute of Technology research staff is assisting the Bureau in this project.

In Hawaii an appropriation of $1,300,000 has been expended in recent years in repairing damage to the main Island of Hawaii caused by the disastrous tidal waves of April 1946. The program, conducted as a joint cooperative undertaking with the territorial and county authorities of the Islands, has to date included reconstruction of pier facilities, community buildings, water and sewer systems, clinics, and schools.

During the past 15 years the Bureau, or its predecessor agencies, has aided in the construction of over $4,000,000 of public works in Alaska, including all types of community facilities such as sewer and water works, streets, schools, and hospitals. The Bureau has also aided recently in the advance planning of 27 proposed projects, involving an estimated construction cost of $13,500,000.

Legislation, introduced in the 81st Congress, would provide funds for a program of public works to assist in the further development of Alaska. Such legislation would aid the local and territorial governments in the financing and construction of projects needed to maintain the health and welfare of the various communities, and thus speed the economic development of the territory.

◆

Coast Guard Offers Civil Engineers Commissions

A program of commissioning young engineering and architectural graduates as ensigns and lieutenants in the officer corps of the Coast Guard has been announced by Commodore N. H. Leslie. Civil engineering officers in the Coast Guard are given valuable experience in all phases of their profession in the construction, alteration, and maintenance of its 22,000 fixed structures and shore establishments in all parts of North America and the islands of the Pacific. The maximum age limit is 30, and salary and advancement are the same as for commissioned officers of equal rank in the other armed services.

Inquiries should be addressed to Commodore N. H. Leslie, U.S. Coast Guard Chief, Office of Personnel, U.S. Coast Guard, Washington 25, D.C.

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Vice-President Proctor Made Moles President

ASCE VICE-PRESIDENT CARLTON S. PROCTOR (left) is inducted into presidency of Moles, New York society of heavy construction men, at dinner meeting of organization held at Hotel Roosevelt on May 4. Shown with him are Christian Henrichson (center) and J. Rich Steers, Jr., outgoing president. Other new Moles officers are J. F. Salmon, first vice-president; Richard V. Hyland, M. ASCE, second vice-president; G. P. Walker, secretary; and Ralph W. Atwater, Assoc. M. ASCE, treasurer.

Crop Yield Is Increased by Overhead Sprinkling

Overhead irrigation by rotary sprayers increases crop production with less than half the water needed for ditch or furrow irrigation, according to a recent issue of the Industrial Bulletin of Arthur D. Little, Inc. These high-pressure revolving sprayers are fed by portable pipe systems, and a single sprayer, moved four or five times a day, can cover several acres. Many produce as much as an inch of "rain" per hour.

Successful use of overhead spraying of corn is reported in the Columbia River Basin, where an acre yielded 193 bushels in comparison with a normal production of 45 bushels. In the South long-range sprinklers are proving effective for supplemental above-tree irrigation of peach orchards (see page 662 of the October issue). The British report success with overhead spraying of sugar beets on farm scale and a 20 percent increase in carrot crop yield.

In both the United States and Great Britain, it has been found that small amounts of nitrogen fertilizers must be added to the spray periodically to counteract the effect of the excessive moisture leaching the nitrogen from the soil.

◆

ASCE Members Honored at Wisconsin U. Centennial

Several ASCE members were among 15 University of Wisconsin alumni receiving "distinguished service citations" at a recent Engineers' Day Dinner, sponsored by the dean and faculty of the College of Engineering as part of the university's centennial celebration. These were Leroy F. Harza and Louis R. Howson, Chicago consultants; J. F. Roberts, manager of the hydraulic department, Allis-Chalmers Manufacturing Co., Milwaukee; and Leon A. Smith, superintendent, Madison Water Department.

◆

Expressways to Airports Will Cut Travel Time

To make transport by air realize to the full its principal objective of saving travel time, expressways between airports and downtown areas are vitally needed in a number of American cities, according to the current issue of *Out at the Airport*, publication of the Airport Division of the American Road Builders' Association. In support of its statement, the publication calls attention to the fact that, while actual flying time between San Francisco and Los Angeles is only 120 minutes, passengers must spend 75 minutes traversing the 26 miles of highway that connect these cities' principal airports with their downtown business centers during peak traffic conditions. In other words, more than 60 percent as much time is required to cover only 5 percent of the highway transport phase of the trip.

An even more spectacular differential in time spent in the air and that required for ground transport is cited in the case of air travel between Detroit and Cleveland. Here the 105 miles separating two big industrial areas require only 54 minutes to negotiate by air, and 100 minutes, nearly twice as long, for the round trip between the principal airports of these cities and their downtown areas.

While admitting that excessively disproportionate time-differentials in air travel and ground transport phases of civil aeronautics are found at relatively few locations, the publication emphasizes the fact "that aggressive and prompt remedies are needed to correct poor traffic conditions." Corrective measures under way in Detroit include development of the Wayne County Major Airport, which will eliminate 14 miles of ground transportation involved in air travel there. Tentative plans for construction of another airport immediately across the Detroit River at Windsor, Canada, would reduce travel time between the airport and the center of the city to 10 minutes, a sensational reduction from the 60 minutes required at peak traffic, between Detroit and its airport at Willow Run.

Reporting results of a nation-wide survey conducted by the ARBA, the publication states that when expressways are completed between downtown areas and principal airports, land travel-time between airports and cities will be reduced an average of 35 percent. Typical of the 59 cities studied is New York, which has 58 traffic lights between mid-town Manhattan and its International Airport at Idlewild. Building of expressways will permit the elimination of 48 of these lights, according to the survey. In conclusion, the publication emphasizes the fact that such express highways between cities and their airports will benefit far more than the relatively small segment of the population that constitutes airport users.

Concrete-Placing Method Tested by Army Engineers

Extensive investigations of the strength and durability of concrete placed by the "Prepakt" method are being made by the Army Corps of Engineers at the Clinton, Miss., sub-office of the Waterways Experiment Station. For the purpose of making the tests two models have been constructed by the Prepakt process—one an 85-cu-yd section of a dam containing galleries and tunnels, and the other a 15-cu-yd model of a reinforced concrete bridge pier. Later these specimens will be subjected to a series of tests for strength and durability.

The Prepakt method, which does away with concrete mixers and involves placing the coarse concrete in the forms and later filling in the remaining space with a cement base intrusion grout, was developed by the Prepakt Concrete Co., of Cleveland, Ohio.

Part of an extensive program of civil works investigations initiated by the Office of the Chief of Engineers, the present study is being conducted under the supervision of Herbert L. Cook, chief of the Concrete Research Division of the Waterways Experiment Station. Thomas B. Kennedy is project engineer representing the government, and J. H. Bowman for the Prepakt Concrete Co.

Relief Wells Aid in Flood Control Program

WROUGHT IRON CASING IS SET in relief well at Kansas City, Mo., Municipal Airport. One of series being sunk in connection with Missouri River Basin flood control program, well is designed to prevent sand boils on land side of levee by relieving upward pressure of water during flood stage. Completed wells are connected to pipe collection system to permit pumping of flood water back over levee into river. System represents new and successful method of pressure control of underseepage pioneered by Army Corps of Engineers.

Cut Truck-loading Time...

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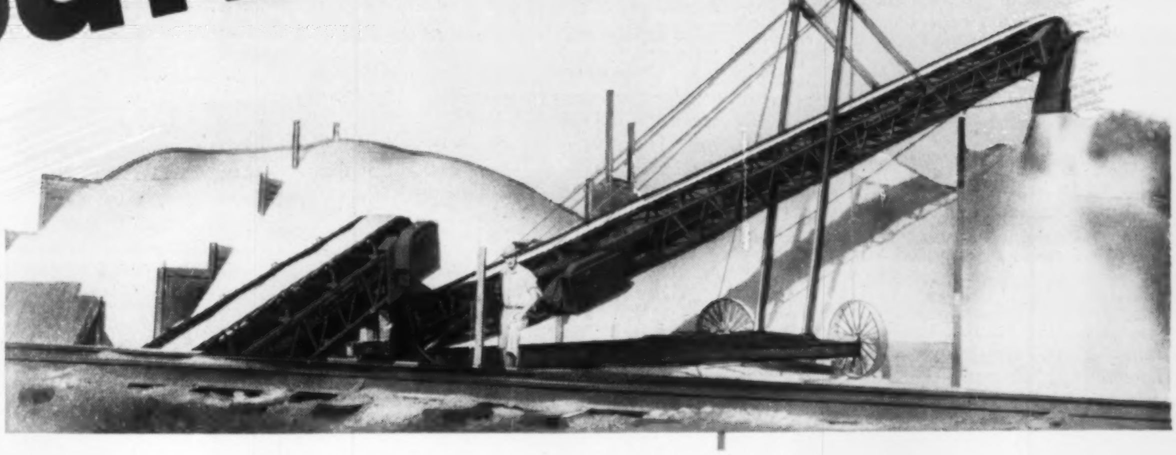

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B-G Portable Conveyors are available in a broad range of capacities and types.

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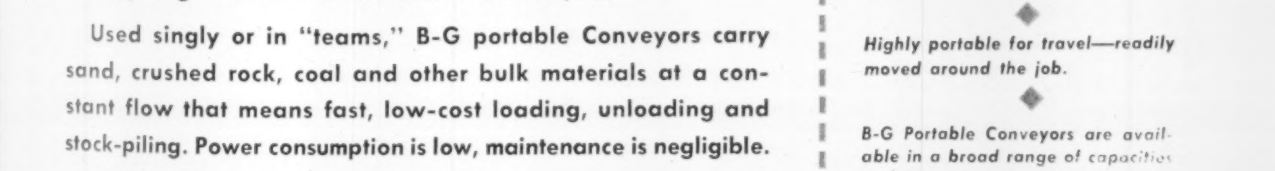
Constant Flow Equipment



N. G. NEARE'S Column

R. Robinson Rowe, M. ASCE

"AN EASY PROBLEM can be just as hard as you want to make it," mused Professor Neare. "Look at this month's assignment, for example—how fast must a plane travel to fly from pole to pole by daylight. I made it easy by eliminating ellipticity, refraction and twilight, but I'll bet Joe Kerr computed in miles per hour instead of knots."

"You forgot," replied Joe, "that I was in the Navy, which teaches that knots are minutes per hour or seconds per minute. Probably, also, you expected me to divide the 10,800 min of arc between poles by 12 hours of flight and answer '900 knots.' But sometimes I'm smarter than you think; in fact I found that a speed of only 535 knots would be enuf."

"How?"

"Well, to begin with, the flight must be made at an equinox to have daylight at each pole. With the sun over the equator, a plane traveling at 535 knots on the 53°30′ parallel could keep up with the sun indefinitely and, at that speed, it could run from Lat 53°30′ S to Lat 53°30′ N in just 12 hours. Easy. It so happens that speed is 10 times the latitude and latitude is 90 times its cosine, which I solved by cut and try."

"Good, so far," conceded the Professor.

"But not good enuf," retorted Cal Klater. "Joe's 12-hour run could have been made on a meridian, but if he had made a westing of 15°, he would have had 13 hours to run a slightly greater distance. Obviously this is a max-min exercise, which is set up easily if we realize that the flight has two equal parts if we cross the equator at noon with the sun in the zenith. Then, if V = the velocity of the plane in knots and θ = the arc of the great circle (OD in Fig. 1) which it flies before sunset catches up with it, we have from spherical trigonometry:

$$\frac{900}{V}\cos\theta = \sin\frac{900\,\theta}{V}$$

Now this interesting relation has an infinitude of minima for V, but the only one that can be reached without flight thru some period of darkness is that for $\theta = \frac{\pi}{2}$ and $V =$ 450 knots, which is the answer."

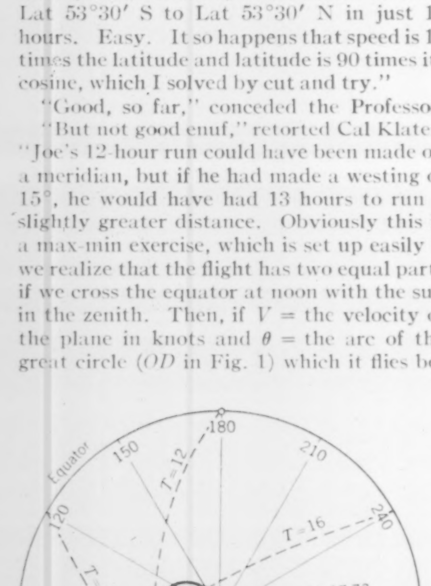


FIG. 1. POLAR AZIMUTHAL PROJECTION makes plane's half-path half-hearted.

"I'd like to explain something and then make the easy problem harder," said Ken Bridgewater. "For Cal's solution, it takes 12 hours before sunset catches him at Lat 60°N, Long 90°W, after which he is flying due west on the parallel. He would never get to the pole except for the sun's increasing declination, which already amounts to 0°11′56″. Because of this small declination at the critical time, a slightly different course would require a speed of only 449.14 knots."

"Good, but too good," agreed the Professor. "And now that you know how little precision is wanted, let's try a sequel. How fast a plane is needed to fly by daylight from a point on the equator to the pole and back?"

[*Joe Kerr was very numerous. Cal Klaters were: Stoop (John L.) Nagel, Ed C. Holt, Jr. and Anne Othernut. Stoop contributed Ken Bridgewater's refinement and also found $V = 447.84$ if daylight ends when the sun's upper limb is on the horizon.*]

◆

Corps of Engineers Opens Bids on Large Projects

BID OPENINGS ON several large Corps of Engineers construction projects have been announced in a summary chart prepared by the office of the Chief of Engineers. These projects include:

Excavation of canal and construction of levees for the Chain of Rocks Canal in the Mississippi River, Madison County, Illinois, under the St. Louis, Mo., District ($7,000,000 to $12,000,000). Excavation of approximately 23,000,000 cu yd of earth to form a canal 7.4 miles long, with a bottom width of about 300 ft (June 1).

Construction of Texarkana Dam on the Sulphur River, Bowie County, Texas under the New Orleans, La., District ($4,000,000 to $6,000,000). Earth embankment 50 ft maximum height by 21,500 ft long; approximately 3,500,000 cu yd embankment, 110,000 cu yd riprap, and 75,000 cu yd gravel (June 9).

Relocation of Southern Pacific Railroad, Lookout Point Dam, Ore. (June 14). Initial clearing of damsite and borrow areas excavation and embankment, river diversion, and spillway excavation, Lookout Point Dam, Ore. (June 15). Both under Portland, Ore., District. Cost of each project from $2,000,000 to $3,000,000.

Construction of concrete dam, Smith River, Va. (Philpott Project), including furnishing of all aggregate and cement. Under the Norfolk, Va., District ($7,000,000 to $10,000,000) (June 14).

Map Distribution Center Established in Denver

FOR THE CONVENIENCE of persons living west of the Mississippi, the U.S. Geological Survey has established a Map Distribution Center in Denver, Colo., according to an announcement from W. E. Wrather, director of the Survey. Topographic and geologic maps of areas west of the Mississippi may now be obtained by addressing requests to the U.S. Geological Survey, Denver Federal Center, Denver, Colo. Maps of Eastern areas should still be ordered from the Director, U.S. Geological Survey, Washington 25, D.C.

◆

Construction Roundup

From the Construction Industry Information Committee—Washington, D.C.

COST OF ALL types of construction has risen less in the period during and after World War II than in the comparable period of the first World War. Although the building industry has been subjected since 1939 to the most violent increases in demand in its history, the relative rise in construction costs during the nine-year period through 1948 has been 13 percent less than in the shorter period from 1914 to 1920, according to the Department of Commerce composite of indexes which reflect construction costs.

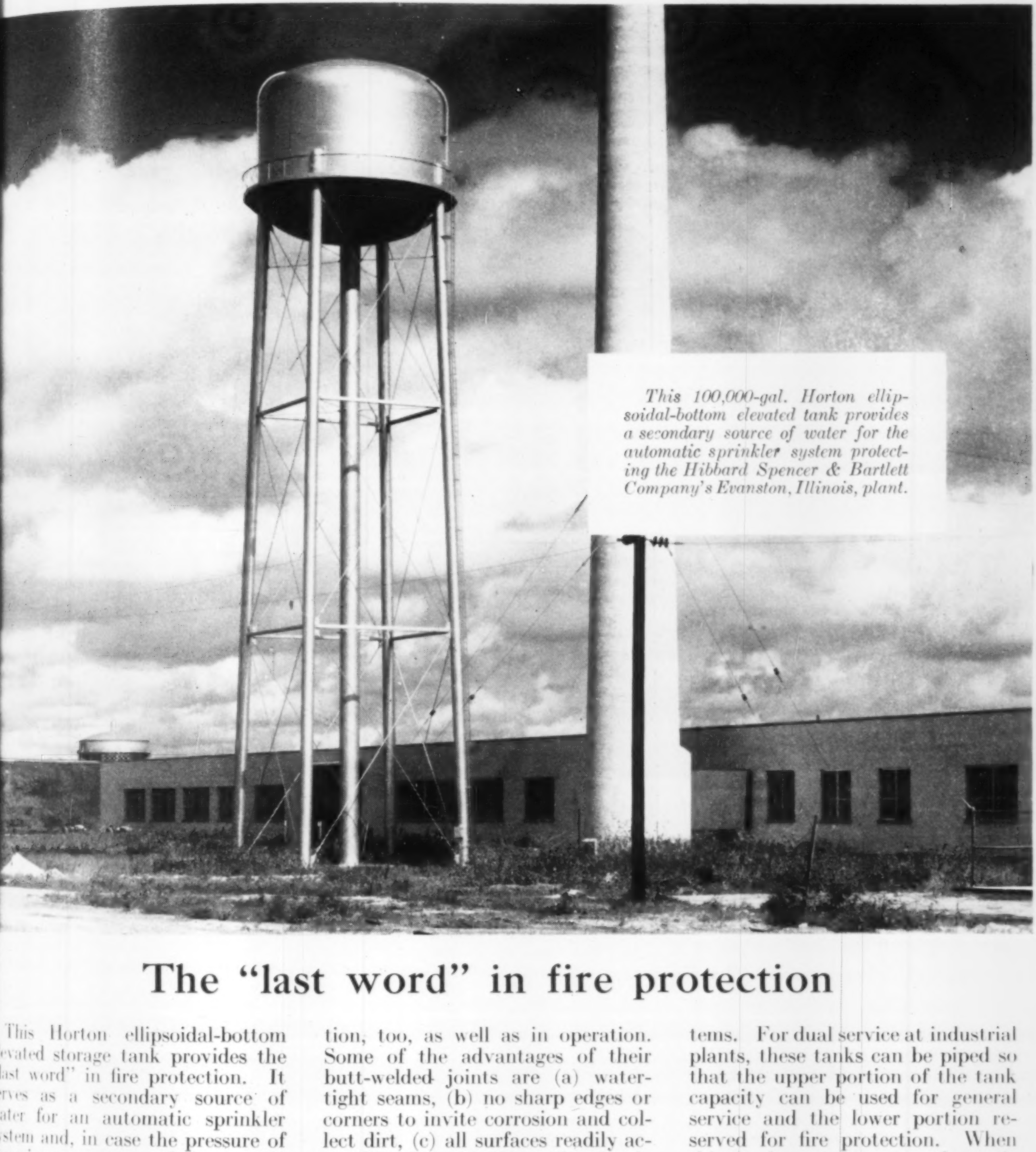
The rise from 1929 through 1948 was 112 percent for all types of construction, as compared with an increase of 128 percent in the 1914–1920 period.

Moreover, housing costs, which have been particularly subject to inflationary pressures, have held rather well in line with construction costs as a whole. The rise from 1939–1948 was 114 percent compared with 128 percent for the 1914–1920 period, according to the Boeckh index of residential construction costs.

Wholesale prices of building materials rose only 120 percent in the 1939–1948 period, in contrast to a 185 percent rise in the 1914–1920 period. This is a testimonial to the efficient way in which the building industry has met and handled the greatest demand ever made on it.

One of the main sources of improvement in price behavior in the present postwar period has been the progress that the industry has made between the two wars in technological development, organization, production, and capacity. After the recent war, its response to unprecedented demand showed amazing flexibility. The industry was able to adapt itself quickly to the sharp reversal in requirements which occurred when the war ended. The output of building materials was expanded to record-breaking levels within two years, and within three years after the end of the war a sustained and ample supply and distribution of materials was attained.

Modern plants and production lines made such consistent, and sometimes sensational gains, that there were no runaway building costs such as might have developed from prolonged scarcity or the threat of such scarcity.



This 100,000-gal. Horton ellipsoidal-bottom elevated tank provides a secondary source of water for the automatic sprinkler system protecting the Hibbard Spencer & Bartlett Company's Evanston, Illinois, plant.

The "last word" in fire protection

This Horton ellipsoidal-bottom elevated storage tank provides the "last word" in fire protection. It serves as a secondary source of water for an automatic sprinkler system and, in case the pressure of the primary water supply is not adequate, the elevated tank can be relied on to provide immediate gravity water pressure to quench the flames before they have a chance to gain headway.

Horton elevated water storage tanks are dependable in construction, too, as well as in operation. Some of the advantages of their butt-welded joints are (a) watertight seams, (b) no sharp edges or corners to invite corrosion and collect dirt, (c) all surfaces readily accessible for painting, (d) simple maintenance requirements—usually just regular painting, and (e) smooth, graceful appearance.

Horton ellipsoidal-bottom elevated tanks are built in capacities from 15,000 to 500,000 gallons for use with automatic sprinkler systems. For dual service at industrial plants, these tanks can be piped so that the upper portion of the tank capacity can be used for general service and the lower portion reserved for fire protection. When this is done, a separate domestic service line is installed which cannot draw water from the tank below a pre-determined level. When you plan to install an elevated water tank for industrial or municipal service, write our nearest office for quotations.

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Detroit 26..........1541 Lafayette Bldg.
Havana..........402 Abreu Bldg.
Houston 2..........2128 National Standard Bldg.
Los Angeles 14..1556 General Petroleum Bldg.
New York 6..........3395-165 Broadway Bldg.
Philadelphia 3....1652-1700 Walnut St. Bldg.
Salt Lake City 1..1509-1st Security Bank Bldg.
San Francisco 11...1284-22 Battery St. Bldg.
Seattle..........1309 Henry Bldg.
Tulsa 3..........1647 Hunt Bldg.

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NEWS OF Engineers

Maj. Gen. Philip B. Fleming, Federal Works Administrator, Washington, D.C., has received President Truman's appointment as chairman of the U.S. Maritime Commission. General Fleming's long career of public service includes assignments as coordinator of the Resettlement Administration, district engineer at St. Paul in charge of the 26 lock-and-dam project on the Upper Mississippi, and head of the Wage and Hour Division of the Labor Department. He has been instrumental in building up the Federal Works Agency, which he has headed since 1941. General Fleming will be succeeded as administrator by **Jess Larson,** former War Assets Administrator.

Philip B. Fleming

William Gahr, previously associate sanitary engineer for the North Dakota State Department of Health, will become sanitary engineer of the department succeeding **Gilbert Groff.**

D. B. Steinman, New York consultant and authority on the design and construction of bridges, was recently initiated into the Columbia University Chapter of Tau Beta Pi, honorary fraternity, with a citation for "character, leadership, and outstanding achievements in the engineering profession."

D. M. Forester, construction engineer for the Bureau of Reclamation on the Shadehill Dam, near Lemmon, S.Dak., was recently initiated into Tau Beta Pi, honorary engineering fraternity. The honor, given in recognition of merit and distinguished service, was conferred by the University of Minnesota Chapter for Georgia Alpha Chapter of his alma mater, the Georgia Institute of Technology.

Ralph E. Fadum, now professor of soil mechanics at Purdue University, will assume new duties as head of the North Carolina State College Department of Civil Engineering on July 1, succeeding **Prof. C. L. Mann,** who retired from the position last fall after more than 50 years on the faculty. Dr. Fadum was on the faculty of the Harvard University Graduate School of Engineering from 1935 to 1943.

Delmar L. Bloem, associate research engineer, will succeed **Fred F. Bartle,** as assistant director of engineering of the National Sand and Gravel Association and as assistant to the director of engineering of the National Ready Mixed Concrete Association. **E. J. Zeigler,** since 1946 assistant research engineer, will become associate research engineer in direct charge of laboratory activities.

C. M. UPHAM, ENGINEER-DIRECTOR, American Road Builders' Association, Washingto (second from right) is presented with Sigma Tau award for distinguished professional achiev ment in ceremonies held at College of Engineering, University of Florida, May 10. Show left to right, are: Dr. J. Hillis Miller, president, University of Florida; Alfred A. McKetha chairman, State Road Department, Tallahassee; Dean Joseph Weil, College of Engineerin Mr. Upham; and J. H. Dowling, State Road Department, Tallahassee, toastmaster at banque Mr. Upham heads ASCE committees on arrangement for Mexico City Meeting.

Edward A. Miller, chief engineer and manager of the Building Panels Division of Detroit Steel Products, has been named chairman of the light gage steel manufacturers and fabricators group of the American Iron and Steel Institute.

R. A. Schroeder recently resigned as director of administrative planning for Willys-Overland Motors, Inc., of Toledo, Ohio, to accept the position of supply manager for Ford International, with headquarters in New York City. Mr. Schroeder held various executive posts with General Motors Overseas Operations prior to joining the staff of Willys-Overland in 1946.

Frederick S. Schwinn, assistant chief engineer of the Missouri Pacific Lines, Houston, Tex., was elected president of the American Railway Engineering Association at its recent annual convention in Chicago.

Lewis L. Gwin, until recently engineer for Blair County, Pennsylvania, has been appointed city engineer of Altoona, Pa. Mr. Gwin served as a major during the second world war.

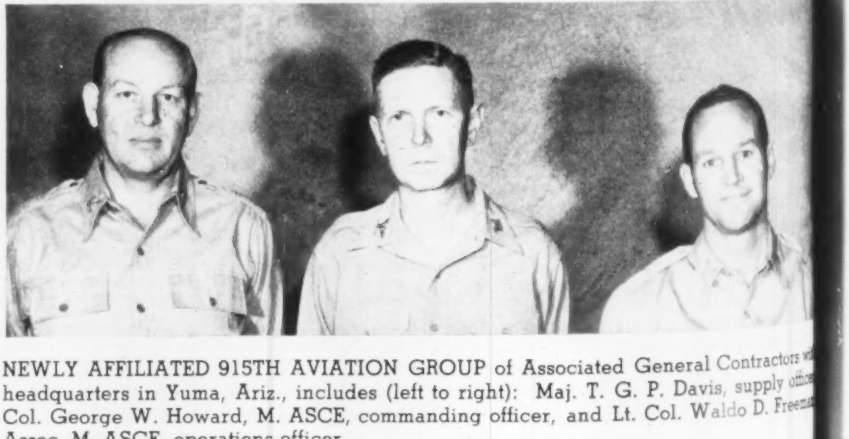
A. O. Dority is now with the General Pr cision Laboratory at Pleasantville, N.Y which handles projects for twelve manufa turing companies and the Navy and A Force. Until recently he was in the Navy a director of the David Taylor Model Basin.

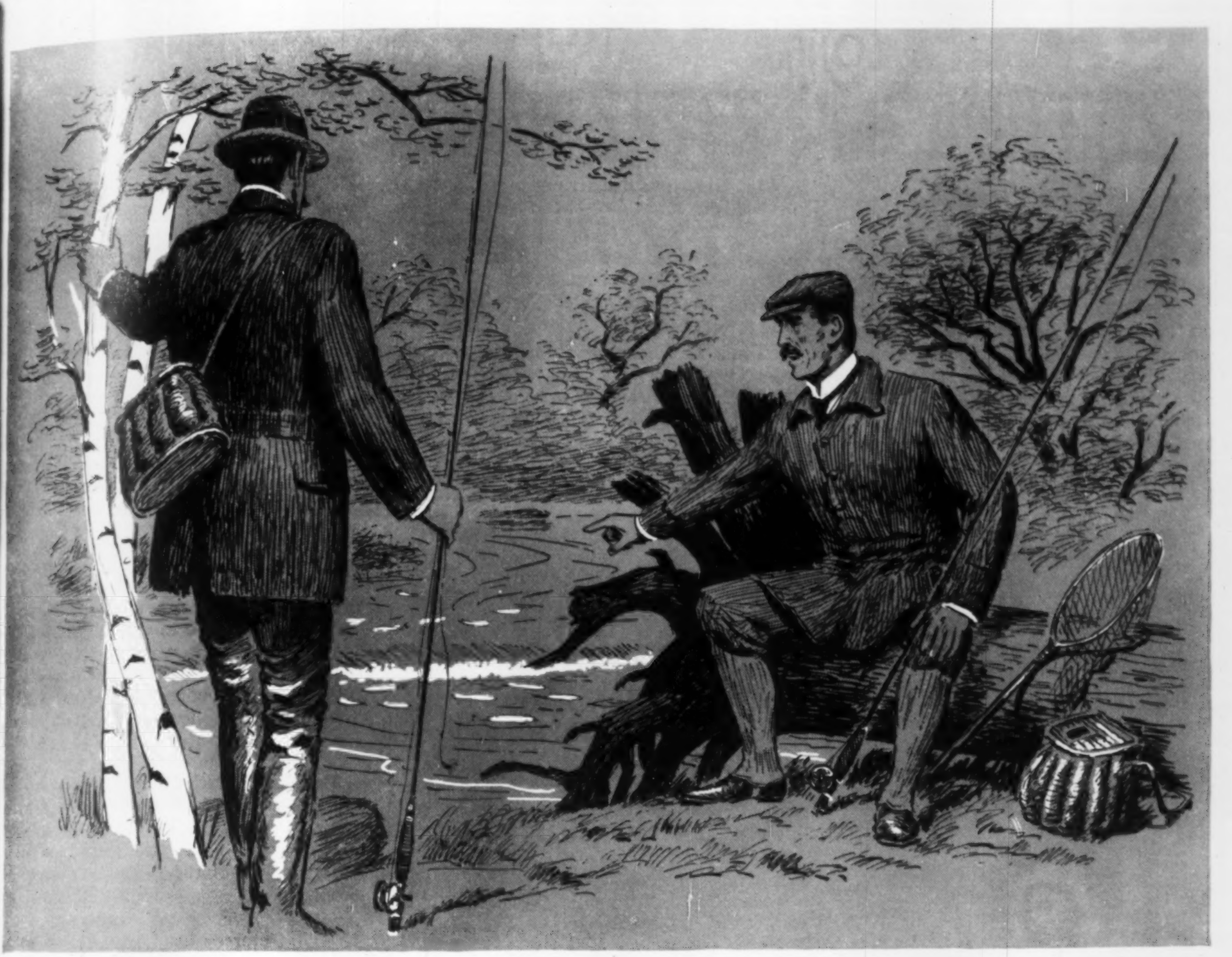
Carroll H. Coberly, consulting engineer Denver, Colo., is now engineer for th Wheat Ridge, Colo., Sanitation District.

Joseph I. Perrey has been transferre from the Indianapolis, Ind., Geologic Survey office to the Charleston, W.Va., Di trict. Except for a military furlough fo approximately four years, Mr. Perrey ha been with the U.S.G.S. since 1927.

Milton I. Wallace, lieutenant colonel i the Army Corps of Engineers, will becom post engineer of Raritan Arsenal, Metuche N.J., completing an assignment at Fo Warren, Wyo.

Marshal McCord, previously assista engineer for the J. E. Greiner Co., consul ing engineers of Baltimore, Md., is now res dent engineer for the organization on th construction of the Mystic River Bridge a Boston, Mass.


NEWLY AFFILIATED 915TH AVIATION GROUP of Associated General Contractors w headquarters in Yuma, Ariz., includes (left to right): Maj. T. G. P. Davis, supply offic Col. George W. Howard, M. ASCE, commanding officer, and Lt. Col. Waldo D. Freema Assoc. M. ASCE, operations officer.



"Look at those trout belly-up, Joe that means big trouble!"

Sanitary engineering has achieved notable progress in stream pollution control during the past half-century. Sewage treatment was introduced in 1899, the year our Company was organized. Today, more than 6,000 sewage treatment plants serve over half of our urban population. And substantial progress is being made in decontaminating industrial wastes discharged into streams and other waters.

Water supply and gas service have also made notable contributions to better health and living in the past 50 years. Today, more than 12,000 public water supply systems serve 85 million people with safe and palatable water. More than 20 million families are furnished with gas for cooking and heating.

After 50 years of manufacturing cast iron pressure pipe primarily and principally for water, gas and sewerage service, we too can point to a record of progress. In pioneering new and better production methods, such as the centrifugal process of casting—in improved quality controls—and in facilities for research and development. Cast iron pressure pipe as produced today in our several foundries bears witness to that progress—in terms of strength, toughness and uniformity.

To those responsible for the great progress in water supply, gas and sanitation service and their contribution to better health and living over the past fifty years, America pays tribute.

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1899-1949
U. S. Pipe & Foundry Co.
Makers for 50 years of cast iron pipe for water, gas and sewerage service.
General Offices: Burlington, N.J.

(*Continued from page 80*)

Newly elected officers of the Connecticut Society of Civil Engineers include ASCE members: **John F. Willis,** of West Hartford, president; **William S. Wise,** of West Hartford, second vice-president; and **H. Jackson Tippett,** of New Haven, secretary-treasurer.

Harold G. Garner, since 1946 paving engineer for the Portland Cement Association at Topeka, Kans., has been made district engineer of the Omaha, Nebr., office, succeeding the late C. W. Hiner. Mr. Garner will direct field work in the State of Nebraska under the general supervision of west central regional manager R. F. Dierking.

John E. Hoving was recently named district engineer for the Northern Pacific Railway Co. Lines East of Livingston, Mont., with headquarters at St. Paul, Minn. **W. R. Bjorklund,** former division engineer at Glendive, Mont., has been appointed St. Paul office engineer.

Irving Ryder, who is a civil engineer with the Joshua Hendy Iron Works, Sunnyvale, Calif., has been elected director of the Engineers Club of San Jose.

Dana E. Kepner, manufacturers' representative of the Water Works, Sewerage and Power Equipment, has been elected to the board of directors of the Colorado Society of Engineers.

Gustave G. Werner, Jr., partner of Malcolm Pirnie, Engineers, of New York, has returned from Greece, where he served for 20 months as chief engineer for an American contractor group on American Mission for Aid to Greece, restoring railroads and other communications facilities there. Mr. Werner was honored by the Greek government by the award of the "Golden Cross of the Greek Phoenix Regiment."

G. G. Werner

Howard T. Critchlow, previously chief engineer of the Division of Water Policy and Supply, New Jersey State Department of Conservation, has been appointed director of this division in the reorganized Department of Conservation and Economic Development, retaining direct supervision over division engineering activities. Mr. Critchlow is a former Director of the Society.

David H. Harker recently resigned as chief engineer of the Indiana State Flood Control and Water Resources Commission, Indianapolis, to take the position of secretary-engineer of the Indiana Drainage Association.

C. J. Peterson has taken over the duties of town manager of the City of Wray, Colo. Previously Mr. Peterson was with the Fairbanks-Morse Co., Wichita, Kans.

H. Lloyd Nelson, for the past 25 years on the staff of the U.S. Pipe and Foundry Co., Burlington, N.J., has been granted a leave of absence to serve as president and general operating manager of the Pontusco Corp. and its subsidiary, Pontusco Corp. of Cuba.

M. D. Morris, former U.S. engineering representative for the Instituto Nacional de Obras Sanitanrias of Venezuela, is now with the Bureau of Engineering, Management, and Planning of the New York City Department of Sanitation.

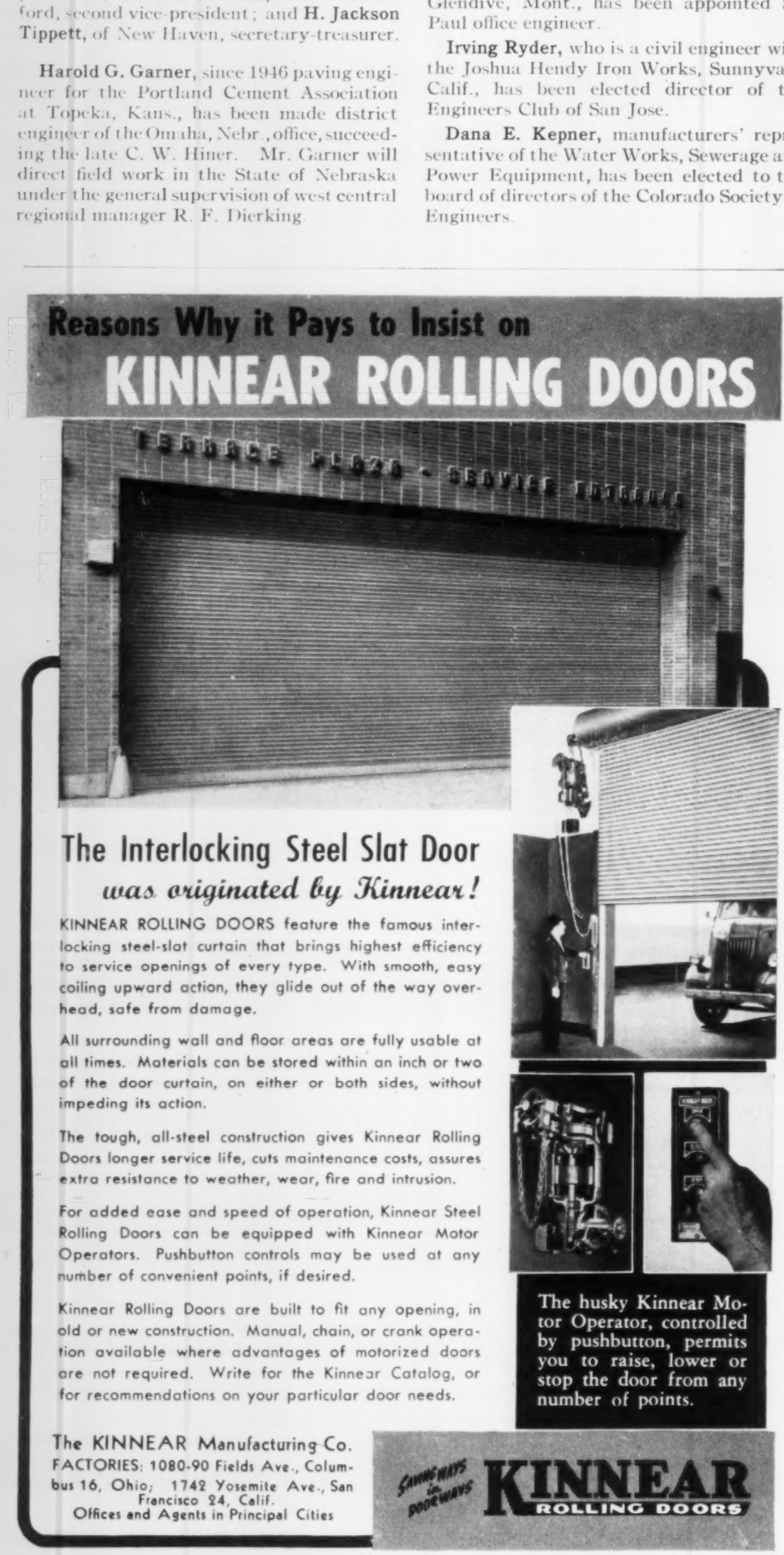
Irving Quinn has been promoted from the position of concrete section chief for the Design Service Co., of New York City, to that of chief engineer.

Edwin L. Driggs recently retired as special planning engineer of the East Bay Municipal Utility District, at Oakland, Calif. Joining the organization in 1924, Mr. Driggs has been designing engineer, office engineer, and since 1946 special planning engineer.

E. B. MacNaughton, chairman of the board of directors of the First National Bank of Portland, Ore., has been made interim president of Reed College.

R. E. Marsh, formerly with the U.S. Geological Survey at Bismarck, N.Dak., is now district engineer in Juneau, Alaska. He has been with the Survey since 1931.

(*Continued on page 90*)



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KINNEAR ROLLING DOORS feature the famous interlocking steel-slat curtain that brings highest efficiency to service openings of every type. With smooth, easy coiling upward action, they glide out of the way overhead, safe from damage.

All surrounding wall and floor areas are fully usable at all times. Materials can be stored within an inch or two of the door curtain, on either or both sides, without impeding its action.

The tough, all-steel construction gives Kinnear Rolling Doors longer service life, cuts maintenance costs, assures extra resistance to weather, wear, fire and intrusion.

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Kinnear Rolling Doors are built to fit any opening, in old or new construction. Manual, chain, or crank operation available where advantages of motorized doors are not required. Write for the Kinnear Catalog, or for recommendations on your particular door needs.

The husky Kinnear Motor Operator, controlled by pushbutton, permits you to raise, lower or stop the door from any number of points.

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KINNEAR ROLLING DOORS

Deceased

James Perrie Alvey (Assoc. M.'13) consulting engineer for the Department of the Interior, Washington, D.C., died in a Boston hospital on March 2. He was 64, and a graduate of Massachusetts Institute of Technology. Beginning in 1919, Mr. Alvey was for a number of years with the Illinois Power & Light Corp. and its subsidiary organizations, which he served as operating engineer, district manager, division manager, and general manager. During the first World War, he served overseas as a captain in the Corps of Engineers.

James Harlan Cissel (M. '23) professor of structural engineering at the University of Michigan, died suddenly on January 29, at the age of 59. A graduate of Purdue University, he spent his early career in railroad engineering. Professor Cissel had been at the University of Michigan since 1915, except for a three-year period from 1932 to 1935, when he was on leave of absence to reorganize the Bridge Division of the Michigan State Highway Department. In the latter assignment, he supervised design and construction of the Mortimer E. Cooley Bridge and other notable structures. Recently he had acted as consultant to the Stran-Steel Division of the Great Lakes Corp., supervising a program of research on the use of thin steel sections for buildings. Professor Cissel was active in many professional societies, and a past-president of the Michigan Section of the ASCE.

Franklin Boyden Gridley (M. '25) engineer and contractor of Pasadena, died on April 2, at the age of 70. Mr. Gridley had been in the contracting business as head of the Franklin B. Gridley Co. in Los Angeles for 30 years. During the first World War he served as a captain of Engineers.

C. W. Hiner (Assoc. M. '48) district engineer for the Omaha District of the Portland Cement Association for the past eight years, died suddenly at his home in Lincoln, Nebr., on April 11. He was 54. A registered professional engineer in Nebraska, Mr. Hiner had been with the Portland Cement Association for 21 years.

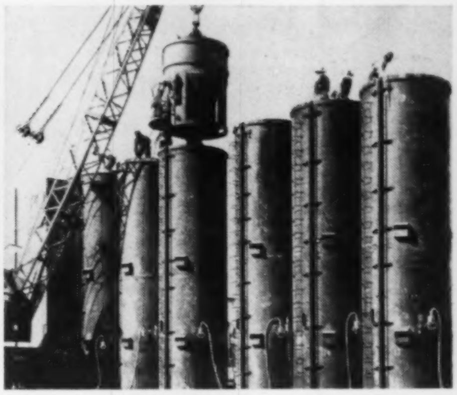
John Hitchcock (Assoc. M. '47) of Los Alamos, N. Mex., died on February 7, at the age of 44. An alumnus of the University of Virginia, class of 1931, Mr. Hitchcock later did graduate work there and made hydrographic surveys of the Mississippi for the U.S. Engineer Department at Memphis. From 1933 to 1940 he was with the National Park Service, and from the latter year to 1945 engineer for the Newport News Shipbuilding & Dry Dock Co. He then became designing engineer for Johannessen & Girand, of Phoenix, Ariz., on a city airport and water system.

Carl Haakon Hoyem (Assoc. M. '46) engineer of Alhambra, Calif., died on February 9.

(Continued on page 84)

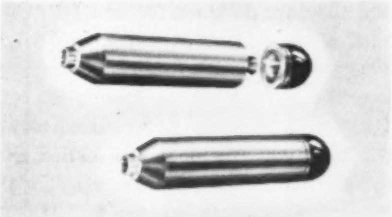
VIBER SAVES TIME AND COST IN CONCRETE CONSTRUCTION

TESTS of NEW DESIGNS and DEVELOPMENT in VIBER EQUIPMENT PROVE INCREASED EFFICIENCY at LOWER MAINTENANCE COSTS



PX-6 EXTERNAL VIBRATOR EXTREMELY EFFECTIVE IN MANUFACTURE OF CONCRETE PRODUCTS and HANDLING OF DRY MATERIALS

The proper balance of amplitude and speed over a wide range produces marked improvement in the manufacture of concrete pipe and greatly increases the life of the forms. Many placement problems have been solved by this new vibrator.



VIBER RUBBER-TIPPED VIBRATORS REDUCE FORM DAMAGE

Damage to expensive form lining materials necessitating frequent form replacement was the reason for development of Rubber Tipped Vibrators. Severe tests on many large concrete jobs proved costly grinding due to damaged forms was greatly reduced. Another advantage of Viber's Rubber Tipped Vibrators is replaceable tip. Simply unscrew worn part and install new tip.

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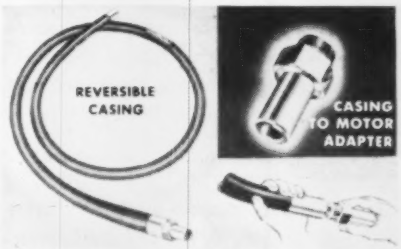
Standard 6, 12 and 21 foot interchangeable Viber casings are reversible. Reversing is easily accomplished by unscrewing adapter and attaching it to the other end. All cores are reversible. Viber casings are covered with durable, live, tire quality rubber.



For further information or descriptive literature on Viber equipment, please write Dept. 18.

VIBER COMPANY • Concrete Vibrators Since 1931

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(Continued from page 83)

He was 38, and a graduate of North Dakota State College. As a field engineer for the State of North Dakota from 1933 to 1936, Mr. Hoyem was in charge of the design of structures for an 8,500-acre flood-control and irrigation project. Later he was area engineer for the WPA in North Dakota, and junior engineer and area engineer with the U.S. Engineers at Fresno and San Bernardino, Calif. More recently he had been engineer for the Par Engineering & Construction Co. at San Gabriel, Calif.

Charles M. Mardel (M. '21) of San Andreas, Calif., died in March at the age of 69. Born and educated in England, Mr. Mardel had spent most of his professional career here. From 1909 to 1912 and, again, from 1922 to 1930, he was with the Great Western Power Co. in San Francisco. Later he was assistant engineer for the Pacific Gas & Electric Co. in the same city.

Charles Adelbert Morse (M. '98) retired chief engineer of the Chicago, Rock Island & Pacific Railway, died in Los Angeles on April 12, at the age of 90. Mr. Morse held numerous engineering positions with the Atchison, Topeka & Santa Fe Railway, and was chief engineer from 1906 to 1913. From the latter year until his retirement he served as chief engineer of the Chicago, Rock Island & Pacific, except for a year during World War I as assistant director of operation and maintenance engineer for the U.S. Railway Administration. He was also one of a wartime committee of three appointed by the Secretary of War as a Board of Review for the Construction Division of the War Department. Mr. Morse was a past-president of the American Railway Engineering Association, the Western Society of Engineers, and the Chicago Engineers Club.

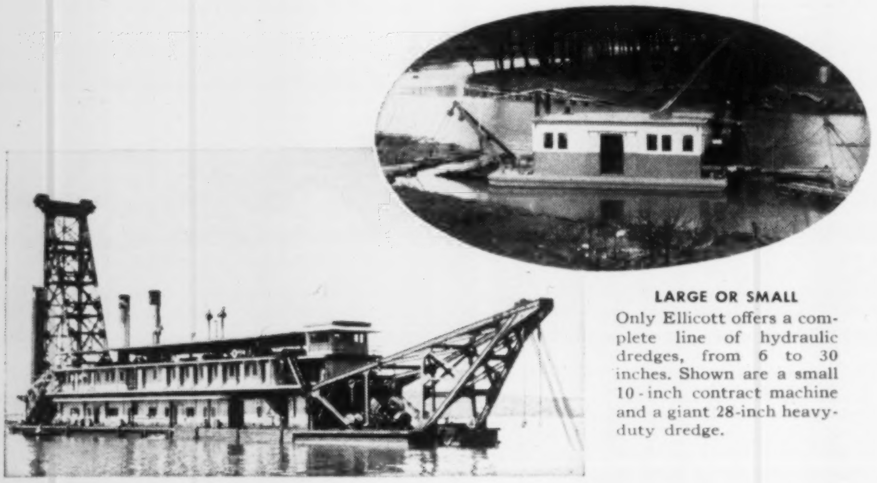
James Benjamin Pendleton (Assoc. M. '36) of Bartlesville, Okla., died on October 7, 1947, according to information just received by the Society. He was 47 years old, and design supervisor for the Phillips Petroleum Co. at the time of his death. Before that he had been structural designer for the Kansas State Highway Commission, at Topeka, and for eleven years he was with the Kansas City Structural Steel Co.

Glenn Vernon Rhodes (Assoc. M. '13) of San Francisco, Calif., died on December 18, at the age of 67. As assistant engineer of the San Francisco Board of Public Works from 1909 to 1911 and from 1914 to 1919, Mr. Rhodes was in charge of all city construction except buildings. He had also been resident engineer for the South San Joaquin Irrigation District in California, in charge of the construction of Goodwin Dam and of 180 miles of distribution system. More recently he was an engineer for the East Bay Water Co. in Oakland, and for Starrett & Eken, of San Francisco.

William von Phul (M '13) retired president of Ford, Bacon & Davis, New York consulting firm, died at his home in Larchmont, N. Y., on April 17. He was 77. Mr. von Phul joined the firm of Ford, Bacon & Davis in 1905, becoming a partner seven years later. While with the company, he had charge of reconstruction of street railways in San Francisco after the earthquake, and had also directed construction and operation of utility and street railway systems in a number of other cities. From 1922 until his retirement in 1944 he was president of the company, and more recently had been chairman of its executive committee.

William Henry Wilson (M. '24) of Chattanooga, Tenn., died on December 23, 1948, at the age of 57. Mr. Wilson was resident bridge engineer for the Tennessee Department of Highways from 1923 to 1927, and city engineer of Chattanooga from 1927 to 1935. Later he was hydraulic and structural engineer for the Tennessee Electric Power Co. at Chattanooga, and during the war served as mechanical engineer in defense contract work for the Wheland Co. at Chattanooga.

S. K. Young (M. '21) of New York City, died on January 18, 1948, according to information just received at Society Headquarters. He was 60. Mr. Young had been chief engineer and secretary of the Upper Scioto Conservancy District at Kenton, Ohio, and field engineer for the Miami Conservancy District. At one time he was on the engineering faculty at Antioch College. More recently he was chief statistician for the New York investment banking firm of Hemphill, Noyes & Co., investigating engineering and other projects for financing.



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ELLICOTT is the only organization that builds and designs hydraulic dredges and dredge components exclusively . . . there is no divided responsibility. That means each Ellicott Dredge is a *balanced unit* because all components work as a team with highest efficiency. Ellicott design also means operating with a minimum of skilled labor, resulting in overhead savings.

Ellicott service starts by designing your dredge for operation under varied conditions so that it outlasts any temporary work. *Proper hydraulic design* eliminates unnecessary wear, and parts that must wear under operation are easy to reach, inexpensive to replace, thus cutting maintenance costs.

Under all conditions, Ellicott Dredges operate at the lowest cost per cubic yard and they are designed for long life. Over 75% of the Ellicott Dredges built before 1928 are in operation today! For economy, long life and usefulness, specify Ellicott. You'll find Ellicott's 63 years of experience will give you complete satisfaction. For complete information, write today for the latest Ellicott Catalog to: ELLICOTT MACHINE CORPORATION, 1607 Bush Street, Baltimore, Maryland, U. S. A.

- ● COMPLETE LINE from 6 to 30 inch equipment for all dredging requirements.
- ● 63 YEARS OF EXPERIENCE with hydraulic dredges.
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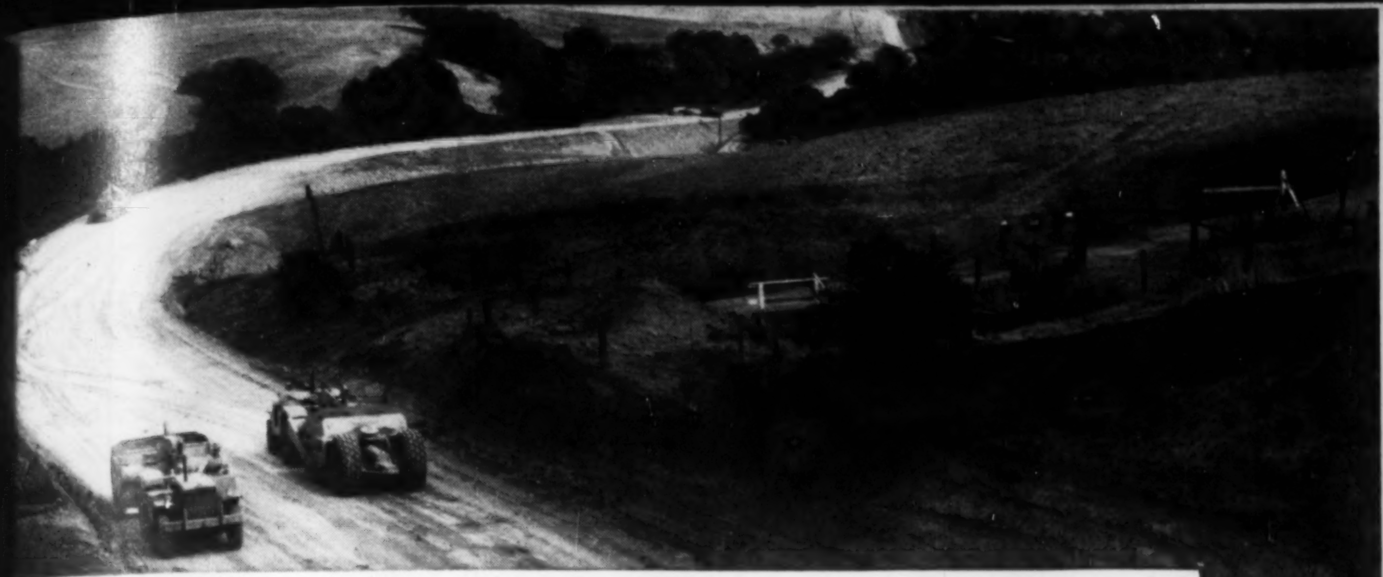

How to move a lot of earth on the double!

This two-fisted "Caterpillar" Diesel D8 Tractor has front-end cable control for the "Caterpillar" No. 8A Bulldozer, and a 2-drum rear control for scraper use.

High-speed hauling by "Caterpillar" Diesel DW10 wheel-type Tractors means money saved on this road-building job in Crow Canyon, Calif.

WHEN there's a big move on, Louis Biasotti and Son, General Contractors, Stockton, Calif., find it good business to use a fleet of "Caterpillar" zoned equipment to get a lot of dirt moved in a hurry. On this road-building job in Crow Canyon, Mr. Al Biasotti, President, singles out his "Caterpillar" Diesel DW10 wheel-type Tractors for special mention.

"The DW10s are doing better than any other rubberized equipment for moving dirt," he says. "We like their speed and handling. They are fought for by our operators."

These fast-stepping, dependable DW10s really go to town for you. They deliver speeds up to 24.5 mph. . . . give more available time per hour . . . have big tires for flotation on soft fills . . . are just the right size (not too big or too small) for the greatest number of jobs . . . and handle like a toy with air brakes and hydraulic booster steering controls.

In addition to DW10s, the "Caterpillar" line-up on this job includes track-type tractors, motor graders, bulldozers and an engine in the shovel. For the many money-saving advantages of "Caterpillar" zoned equipment, get the whole story from your "Caterpillar" dealer.

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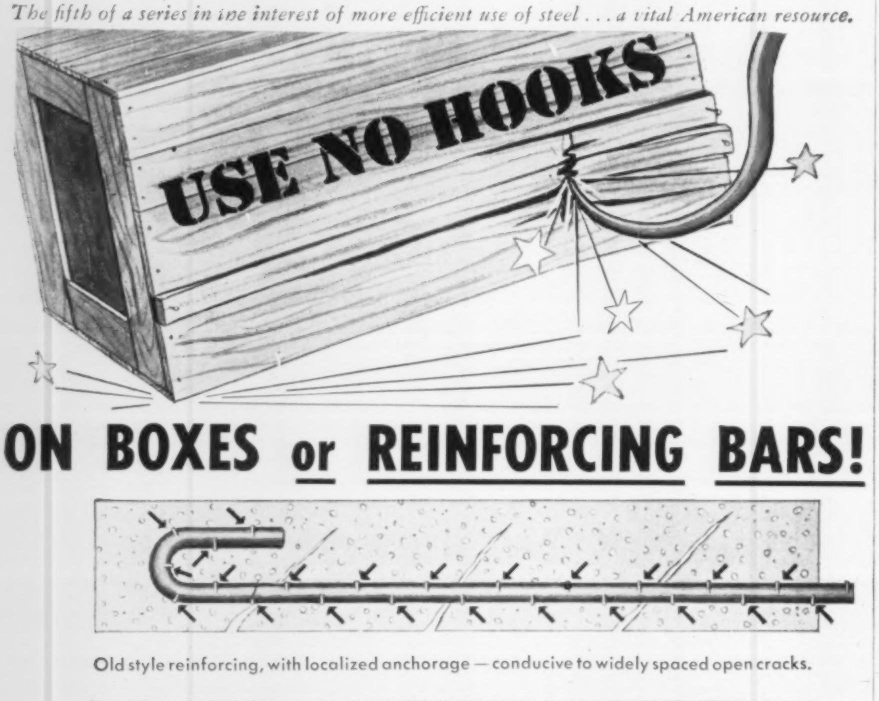
DIESEL

ENGINES • TRACTORS
MOTOR GRADERS
EARTHMOVING EQUIPMENT

Positions Announced

Corps of Engineers. The Portland District of the Corps of Engineers, within the next few months, will need general construction inspectors, CAF-5 through CAF-7, with annual rate of pay ranging from $2,974 to $3,727. An unassembled examination, to establish an eligible register from which to fill these vacancies, has been announced by the secretary of the local Civil Service board, room 628 Pittock Block, Portland 5, Ore., to whom applications for these positions should be sent. Fourteen general construction inspector vacancies, paying $4,188 a year, exist in the North Pacific Division, Corps of Engineers, for duty in Fairbanks, Anchorage, and Whittier, Alaska. Candidates for these positions should submit a fully executed standard form 57 to the Division Engineer, North Pacific Division, Corps of Engineers, 500 Pittock Block, Portland 5, Ore.

U.S. Civil Service. Applications will be accepted by the Board of U.S. Civil Service Examiners, U.S. Naval Training Center, Great Lakes, Ill., for probational appointment to the positions of Research Contract Administrator ($5,232 to $6,235) and Scientific Research Administrator ($5,232 to $7,432). Applicants must have degrees in engineering, mathematics, or the physical sciences from an accredited university, and three years of responsible experience in physical science or comparable administrative positions. Forms for filing applications may be obtained from post offices, regional Civil Service offices, or the Board of U.S. Civil Service Examiners, Great Lakes, Ill.



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Old style reinforcing, with localized anchorage — conducive to widely spaced open cracks.

Laclede Multi-Rib Bars adequately transmit stresses to concrete by uniformly distributed anchorage. Small, closely spaced cracks do not open under load.

The hook, which has been the symbol of bond strength in 30 year old codes has been succeeded by the balanced design of reinforcing bar deformations specified in ASTM Specification A 305-47 T. The balanced design and distributed strength of Laclede Multi-Rib Reinforcing Bars meet these new requirements—assure a more efficient use of steel and a *better* job!

Modernize *your* specifications — with ASTM A 305-47 T and Laclede Multi-Rib Bars!

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LACLEDE STEEL COMPANY
St. Louis, Mo.

◆

Several Western Projects Announced by U.S.B.R.

FORTHCOMING WESTERN construction projects, listed by the Bureau of Reclamation in its *Advance Construction Bulletin* for May 2, under head of "Bid Calls Expected This Month," including the following:

WELLTON-MOHAWK CANAL
Gila Project, Arizona

Location: About 15 miles east of Yuma, Ariz.

Work: Construction of earthwork and structures for 8.5 miles of Wellton-Mohawk Canal, 1,300 cfs capacity, extending from Mile 15 on the Gravity Main Canal to pumping plant No. 1.

Excavation	3,265,000 cu yd
Concrete in structures and lining	4,400 cu yd
Furnishing and placing reinforcing steel	692,400 lb
Furnishing and driving concrete piling	1,000 ft
Furnishing and laying 48-in. diameter welded steel pipe	40,000 lb
Furnishing and placing gravel on county road .	9,740 cu yd
Furnishing and driving sheet steel piling . . .	64,250 lb
Time Allowed for Completion:	525 days

CULBERTSON DAM FOUNDATION
Missouri River Basin Project, Nebraska

Location: On the Republican River, 25 miles west of Trenton, Nebr.

Work: Excavation and construction of the foundation for Culbertson Dam.

Excavation (common) . .	3,600,000 cu yd
Earthfill	2,450,000 cu yd
Time Allowed for Completion:	300 days

WILLISTON SUBSTATION
Fort Peck Project, North Dakota

Location: 4.5 miles west of Williston, N.Dak.

Work: Construction of Williston Substation including furnishing and erecting steel structures and a 24- by 42-ft prefabricated service building. Installation of all electrical equipment including a 15,000-kva capacity main transformer bank, from 115-kv to 69–60-kv, and a 1,000-kva capacity bank, from 69–60-kv to 12.5-kv, station service transformer, oil circuit breakers, switches, and control and station-service equipment. Furnishing and erecting bus structures, transformer bus towers, transformer handling tower, supports, etc.

Time Allowed for Completion:	350 days

Mile-Long Cofferdam Withstands 75-Ft Head

(Continued from page 47)

The cofferdam here described was built by the River Construction Corp.—a firm owned jointly by Al Johnson Construction Co.; Morrison-Knudsen Co., Inc.; Spencer, White & Prentis, Inc.; The Turner Construction Co.; Raymond Concrete Pile Co.; and Winston Bros. Co.—under the supervision of F. B. Spencer, M. ASCE, Manager; R. J. Dunlap, Construction Manager; Alex Jonsson, Assoc. M. ASCE, General Superintendent; and S. C. Doughty, M. ASCE, Principal Engineer. The work was done for the U.S. Corps of Engineers, directed by Division Engineer Col. Clark Kittrell, M. ASCE; District Engineer Col. R. E. Smyser, M. ASCE; and Resident Engineer Lt. Col. Paul La Due.

◆

Meetings and Conferences

American Society of **Heating and Ventilating Engineers.** Ten papers will be presented during the three technical sessions of the semiannual meeting of the American Society of Heating and Ventilating Engineers at the Hotel Nicollet, Minneapolis, Minn., June 20–22.

American Society of **Mechanical Engineers.** All technical sessions of the 15th Applied Mechanics Conference of the American Society of Mechanical Engineers will convene in the Amphitheatre of the H. R. Rackham Building, at the University of Michigan, Ann Arbor, June 13 through 15.

American Society for **Engineering Education.** Partnership with industry will keynote the 57th annual meeting of the American Society for Engineering Education, including the Engineering College Administrative Council and the Engineering College Research Council, to be held at Rensselaer Polytechnic Institute, Troy, N.Y., on June 20–24.

American Society for **Testing Materials.** Featuring 22 technical sessions with highly diversified programs, the annual convention of the American Society for Testing Materials will take place at the Chalfonte-Haddon Hall, Atlantic City, N.J., during the week of June 27.

National Institutes of **Health.** Headquarters for the research symposium on water, sewage, and industrial wastes, sponsored by the Sanitation Study Section, Division of Research Grants and Fellowships, of the National Institutes of Health, Public Health Service will be the auditorium of the Department of Commerce, at Washington, D.C., on June 23 and 24.

Smooth Finish, More Durable Concrete with Hydron Form Linings

The near side of the concrete slab in the above photograph was cast against Hydron form lining. Note the smooth, unblemished surface obtained without expensive rubbing.

Hydron absorbs excess water and eliminates trapped air from the surface. This makes the concrete several times more resistant to abrasion and freeze-thaw conditions. The case hardening effect is gradual from the surface into the mass for about an inch in depth. In addition to these benefits Hydron serves as a curing aid. When the forms are removed Hydron remains on the concrete and can easily be taken off after the desired curing period.

Hydron is mounted on wood forms with rapid fire staple guns and on steel forms with a special adhesive. Furnished in flexible sheets, Hydron can be easily cut or trimmed.

Among the big installations where this product was used are: Fall River Dam, Norfolk Dam, East Sidney Dam, Whitney Dam, Cherry Creek Dam, Soo Canal and lock walls, Chain Rock Canal, Delaware & Chesapeake Canal Bridge Abutments, Maine Turnpike Bridge Abutments.

NEW! Re-usable Rubber Bevel Strips Prove More Economical, More Efficient

The bevels or grooves in the above photograph were made by U. S. Rubber Bevel Strips. These strips produce a smooth finish with straight edges. And being flexible, they are easily removed for many more re-uses.

For more information write Hydron Department, United States Rubber Co., 1 Market Street, Passaic, New Jersey

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City.......... P.O. Zone No.......... State..........

Home Address.......... City.......... P.O. Zone No.......... State..........

Mailing and Publications to ☐ Home ☐ Business

Listing in Yearbook to include: ☐ Home only ☐ Business only ☐ Home and Business

New Publications

City Planning, Chicago. Proposals for a new Civic Center for the City of Chicago are outlined in a graphically illustrated brochure issued by the Chicago Plan Commission. The 40-page bulletin reviews the development of the city and shows how construction of the proposed highly functional Civic Center could be integrated with previous sound development plans such as that proposed early in the century by the successful planner Daniel Burnham. Inquiries should be addressed to the Chicago Plan Commission, City Hall, Chicago 2, Ill.

Plumbing Code. Minimum standards for plumbing installations are detailed in the American Standard Plumbing Code, sponsored by the American Public Health Association and the American Society of Mechanical Engineers. The ASCE was represented on the Sectional Committee on Minimum Requirements for Plumbing and Standardization of Plumbing Equipment (A40) that developed the standard. Inquiries concerning the code, which sells for $2.50, should be addressed to the ASME, 29 West 39th Street, New York 18, N. Y.

Air-Entrained Concrete. The pros and cons of air-entrained concrete are presented in a series of articles on the subject by J. A. Nicholson, president of the Nicholson Concrete Co., Toledo, Ohio. Copies have been made available by the Hercules Steel Products Corp. (Galion, Ohio), from whom free copies may be obtained.

Steel Research. Several new sections in the Steel Products Manual, which is being issued in installments by the American Iron and Steel Institute, are now available at a cost of 25 cents each, upon application to the Institute, 350 Fifth Avenue, New York 1, N. Y. These are Section 21, dealing with "Concrete Reinforcing Bars"; Section 23, entitled "Tolerances for Alloy Steel Sheets and Strip"; Section 25, on "Tool Steel Tolerances"; and Section 27, covering "Rail Steel."

Geologic Investigations. Reports on geologic and seismic studies of major highway locations, bridge sites, and resources of construction materials in Massachusetts, recently completed by the U.S. Geological Survey in cooperation with the Massachusetts Department of Public Works, have been placed in open file in the Survey headquarters in Washington, D. C., and Boston, and at the offices of the Massachusetts Department of Public Works in Boston. The studies will ultimately form part of a pending published report on the mineral and geologic resources of the state.

Building Codes. A proposed Iowa State Building Code, on which state legislation is pending, is now available in printed form, upon application to the State of Iowa, Des Moines, Iowa. The 190-page publication consists of two documents on safe-building construction: The proposed State Building Code Act containing statutes for establishing a uniform state code, and recommended Rules and Regulations, which cover the technical requirements for performance standards prescribing materials, and design and construction of buildings used by the public. The Building Code Council, which prepared the report, is headed by Frank Kerekes, M. ASCE.

Concrete Masonry. Information on concrete masonry construction, including materials, standards, manufacturing processes, curing procedures, and good practice recommendations for building dwelling walls is furnished in Technical Bulletin No. 9 of the Housing and Home Finance Agency. The bulletin emphasizes the point that research in light-weight aggregates and other concretes has increased the importance of concrete masonry as a building material. Inquiries should be addressed to the HHFA Office of the Administrator, Washington 25, D.C.

Land Surveys. Publication of Experiment Station Bulletin No. 71, entitled "Your Land, Surveys, Maps and Titles," has just been announced by the Virginia Polytechnic Institute. The author, Prof. Fred C. Morris of the department of civil engineering, explains two little-understood aspects of land titles—the plane coordinate system for property descriptions and the Torrens System of land titles by registration. Treated also are the practical uses of maps and aerial photographs. Copies may be purchased from Virginia Polytechnic Institute, Blacksburg, Va., at 75 cents each.

(Continued on page 92)

FROM MANDALAY TO MANHATTAN
FROM TOPEKA TO TIMBUKTU . . .

THE SUN NEVER SETS ON

%PROPORTIONEERS% Little Red Pump

%Proportioneers% Heavy Duty Midget Chem-O-Feeder — "The Little Red Pump" — is known and trusted in every corner of the world. To the Chinaman, African, and American alike it means safe, pure water. It handles the all-important jobs of water sterilization, taste and odor control, water softening, and dozens of other water treating applications. Because of its extremely simple, rugged construction, the Little Red Pump can be safely operated by almost anyone. It treats from a few gallons to a million gallons of water a day and feeds chemicals up to 7½ g.p.h. against pressures to 85 p.s.i. The chemical being fed shows plainly in the "See-Thru" plastic head and the action of the valves and diaphragm is clearly visible. Over 27,000 %Proportioneers% units right now are making this a healthier, better world to live in.

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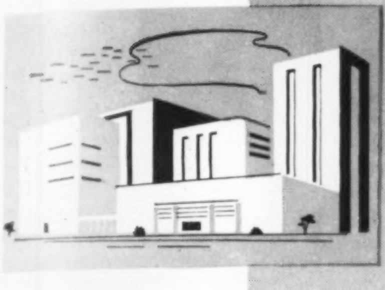
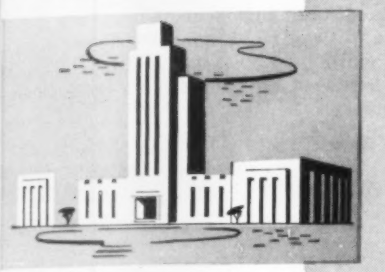
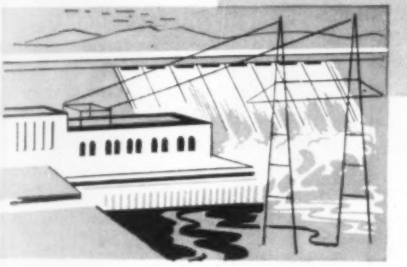
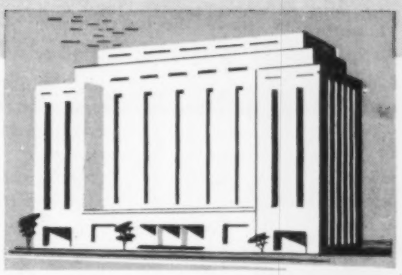
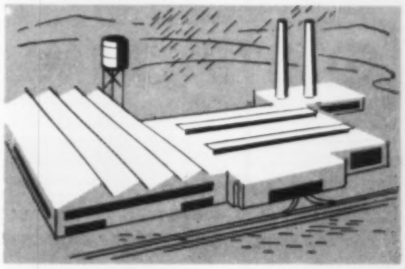








ALL OVER AMERICA—institutions, hospitals, industrial and power plants, schools, hotels and bridges are under construction —and for the structural steel fabrication FORT PITT BRIDGE is an excellent, experienced source of supply.



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(Continued from page 82)

Charles M. Noble, of Princeton, N.J., has been loaned for six months by the New Jersey Highway Department to serve as chief engineer for the new multimillion-dollar New Jersey Turnpike, a superhighway which will run from near the New Jersey–New York border to Deepwater, south of Camden on the Delaware River. The preliminary engineering surveys and studies for this new highway, expected to be in use by 1951, are already under way. A Navy Commander in the last war, Mr. Noble served in Alaska, the Aleutians, and China.

Charles M. Noble

Leon G. Cutler has retired as department engineer for the New York City Board of Water Supply after a number of years of service. He has been in charge of the design of the Merriman, Neversink, and Downsville dams, parts of the Delaware System now under construction, and has been department engineer since 1946.

J. Byron Barber, civil engineer of Spokane, Wash., is one of the newly elected vice-presidents of the Associated Engineers of Spokane.

Dean P. Tsagaris, until recently associated with the Charles T. Main Co., at Atlanta, Ga., is now employed by the Design Department of the Tennessee Valley Authority, Knoxville, Tenn

C. H. Rhudy, who is on leave of absence from the California Electric Co., has been sent by the United States government to serve on the Korean Power Mission, a project to rehabilitate the power facilities of southern Korea. Mr. Rhudy has been on the staff of the California Electric Co. for over 40 years.

Theodore Belzner, for many years with the New York City Department of Public Works as inspector of steel and bridge inspector in charge of Brooklyn Bridge, has been appointed chairman of the Emily Warren Roebling Memorial Committee, which honors the part played by the wives of prominent engineers in making possible many of their achievements.

E. M. Freeman, consulting civil engineer of Shreveport, La., and first vice-president of the Louisiana Section, received the "Honor Award of 1948" of the North Louisiana Chapter of the American Institute of Architects. He was cited for his technical ability, assistance to civic organizations, and for his sincerity and integrity.

John W. Odell, until recently assistant engineer in the Water Resources Branch of the U.S. Geological Survey at St. Louis, Mo., has been appointed engineer in charge of the Ithaca, N.Y., office. Entering the employ of the Survey in 1935, Mr. Odell's experience includes work in California and Minnesota.

Samuel B. Lincoln has been elected president of the Lockwood Green Engineers, Inc., New York City architects and engineers. An authority in the design of industrial plants, Mr. Lincoln has been with the company since 1908. **Chester S. Allen,** who has been president since 1946, was elected chairman of the board of directors.

Frank C. Sellnow has resigned from the positions of chairman of the Army Price Adjustment Board and vice-chairman of the War Contracts Price Adjustment Board to accept an appointment as chief of the Metals Industry Branch of the Korean Mission of the Economic Cooperation Administration, with headquarters in Seoul, Korea.

Claude H. Chorpening, colonel in the Civil Engineer Corps of the Army and for the past three years district engineer of the Tulsa, Okla., District, has been called to Washington, D.C., for duty in the Office of the Chief of Engineers. Flood-control projects constructed during his tenure at Tulsa, include the nearly completed $10,000,000 Canton Reservoir. He was author of an article on the Fort Gibson Dam, now under construction by the Corps of Engineers near Tulsa, in the May issue. A veteran of both world wars, Colonel Chorpening filled engineering and staff assignments in both the European and Pacific Theaters in the recent war. In addition to his responsibilities at Tulsa, he has been acting chief of the Dallas Division office.

Col. Chorpening

William L. Voorduin, of Buenos Aires, Argentina, has accepted a position with Gibbs & Hill, New York consultants.

Richard Bartle, formerly employed by De Leuw, Cather & Co., has joined the staff of the League of California Cities as field consultant, with headquarters in Berkeley. In this capacity, Mr. Bartle will work with city engineers, city planners, and other officials in city public works departments on local problems where assistance of the statewide group will be needed.

Harry E. Frech has retired as district engineer of the St. Louis, Mo., office of the Portland Cement Association after serving for 30 years. He will be succeeded by Carl **J. Chappell,** for the past four years a Missouri field engineer.

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Men Available

Licensed Professional Engineer, New York State; Assoc. M. ASCE; technical education; 20 years' experience steel structures, industrial plants, mechanical equipment, conveyors, technical sales. Prefers Buffalo, N.Y., or western New York State. C-487.

Civil Engineer; Assoc. M. ASCE; 34; married; B.S. in C.E., Caltech., 1936; 13 years' varied office and field experience heavy construction including (in past 8 years) naval service, lieutenant (jg) to lieutenant commander, CEC, and 4 years with private contractors. Prefers California. C-488.

Civil-Sanitary Engineer; M. ASCE; 24 years' experience, project promotion, investigations, reports, design and construction of water and sewage treatment plants, pumping stations, pipelines, power plants, dams, reservoirs, and highways. Capable executive, personable, effective contract negotiator and expert in preparation of specifications. Engineering and legal degrees. Registered several states. Available on short notice. Prefers Southeast. C-489.

Engineer, graduating June 1949, with B.S. in C.E.; 24; single. Desires work in sanitary engineering, but will not pass up other opportunities. Would like to combine further study with work. Prefers New York or New England. C-490.

Civil Engineer; Jun. ASCE; graduate of Villanova College, 1945; 24; single; speaks Spanish. Design experience; experience with heavy wrecking equipment; layout experience; 2 years' experience as construction superintendent for second largest mail-order firm; desires heavy construction field position. Will go anywhere. Available immediately. C-491.

Engineer; Assoc. M. ASCE; 40; married; 2 children; graduate civil engineer, including master's and doctor's degrees. Experience includes 4 years bridge design and 6 years in public works duty as an officer in Naval Civil Engineer Corps. Desires position in research or structural design. Prefers Northeast, Pacific Northwest. Available in July. C-492.

Engineer; Jun. ASCE; 33; single; degrees of B.C.E. and M.C.E. Desires teaching position. Ten years' diversified civil engineering experience, two of which are in teaching of civil engineering subjects. Avocation is effective speaking. Conducted course in effective speaking at ASCE headquarters in NYC. Will teach anywhere in U.S. C-493.

Consultant Manager, Chief Engineer, General Superintendent; Assoc. M. ASCE; registered professional engineer; 43; married fluent Spanish. 20 years' tropical residence. Successful executive background in oilfield development, public works, roads, pipelines, brick plants, housing, industrial developments; also planning, designing, estimating, constructing and operating. Able negotiator. Any location. Available on salary, fee or contract basis. C-494.

Civil Engineer, Assoc. M. ASCE; 32; single; graduate. Experienced in operation and design of water and sewage systems and treatment plants and reinforced concrete design. Employed presently, job to terminate soon. Present salary, $6,400. Prefers West; will consider any location in U.S. C-495.

Civil Engineer, Jun. ASCE; 22; single; civil engineering graduate; 15 months' experience structural designer and in field. Desires employment with firm engaged in industrial or commercial construction. Will locate anywhere in U.S. and do some traveling. C-496.

Positions Available

Instructor, master's degree in civil engineering, preferably with some teaching experience, to teach civil engineering courses. Position starts in the fall. Salary, $3,000 for 9 months, and possibility of summer teaching at the rate of $1,000 for the quarter. Location, Georgia. Y-2382.

Field Engineer, civil graduate with heavy construction experience, to do field work on bridges and foundations. Prefer resident of central New Jersey. Salary, $5,000–$6,000 a year. Y-2385.

Engineers. (a) Chief of Party, with at least 3 years' experience as chief of party on road and street construction, including considerable retaining wall and traffic circles. Salary, $4,680 a year. (b) Transitman with at least 2 years' experience on concrete road work. Salary, $4,180 a year. (c) Rodman, with construction experience. Salary, $3,640 a year. Location New York Metropolitan Area. Y-2400.

Structural Designers, graduates, with 5 to 7 years' experience in reinforced concrete design and structural steel design. Will work on the board and draw up own design; design specialty in either concrete or steel or both. Salary, $4,800–$6,600 a year. Location, South. Y-2401.

Sanitary Engineer, civil graduate, with 2 to 4 years' experience in the sanitary field for office and field work with regulatory organization. Salary, $4,000 a year. Location, New York, N.Y. Y-2409.

Civil Engineer, graduate, with broad experience, a substantial portion of which has been in hydraulics. Excellent opportunity with a large public utility. Apply by letter, stating education, experience and salary requirements. Location, eastern Pennsylvania. Y-2413.

Construction Superintendent with public works experience, to supervise large-diameter water-line construction. Must have cut-and-cover experience for 30-ft depth. Salary, $8,000 a year. Location, northern New Jersey. Y-2416.

Construction Engineer, mechanical or civil graduate, 28–35, with petroleum terminal experience, to supervise waterfront construction, tank erection, draw up contracts, sublet work, etc. Married man preferred with knowledge of Portuguese. Salary, $7,000–$8,000 a year. Location, Brazil. Y-2419.

Irrigation Engineer with at least 10 years' experience in planning, designing, and estimating distribution systems and drainage works and with basic knowledge of agronomy. U.S. engineering firm with initial assignment in Near East. Y-2425.

Designers-Draftsmen, men of promise for advancement; at least 5 years' experience on large high pressure steam power plants. (c) Civil for structural steel and reinforced concrete work; 5-day, 40-hour week. Starting base salary, $5,200 a year, depending on experience. Location, Pennsylvania. R-5264.

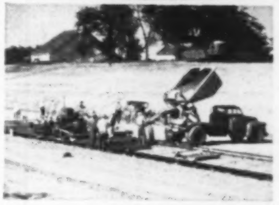
Office or Highway Engineer, experience in pavement design and construction. Able to write effectively. Salary, $4,000–$5,000 a year. Location, Chicago with some traveling. R-5380.

City Planning Engineer, not over 50; registered engineer, experienced in preparation of federal highway plans and with municipal training in water, sewers, and paving. Will be concerned with city planning, water supply, sewer systems, street paving, and state highway planning. Salary, $275–$500 a month. (b) Recent graduates interested in above type of work. Location, Texas. R-5657.

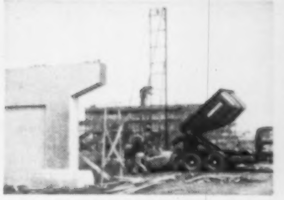
Instructor, graduate civil engineer. Will teach civil engineering subjects, emphasis on applied mechanics, strength of materials, and surveying. Salary, $3,600 for 9 months. Location, Midwest. R-5665.

A NEW UTILITY BODY FOR THE NATION'S BIG HIGHWAY PROGRAM

The Low-Cost Dumpcrete



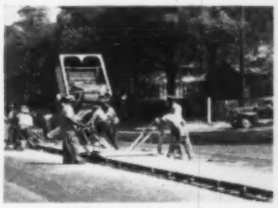
PAVING



BRIDGES

CURB AND GUTTER

WIDENING



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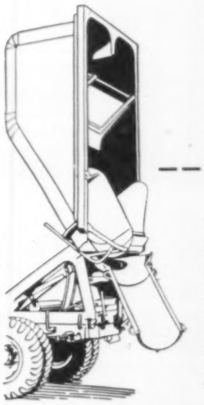

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New Publications

(Continued from page 88)

Highway Research. A recently issued Highway Research Board bulletin (Research Report 6B) on the surface drainage of highways includes a report of the Board's Committee on Surface Drainage of Highways and three papers, presented at the 27th annual meeting of the Board, held in Washington in December 1948. The papers are entitled "Description of Apparatus and Procedure for Testing Flow in Gutters and Storm Drain Inlets," by John C. Guillou, Jun. ASCE; "Theory of Flow Through Short Tubes with Smooth and Corrugated Surfaces and with Square Edged Entrances," by Garbis H. Keulegan; and "Experiments on Flow Through Inlet Gratings for Street Gutters," by Curtis L. Larson. Copies may be purchased from the Highway Research Board, 2101 Constitution Avenue, Washington 25, D.C., at 45 cents each.

Control Surveys. Comprehensive indexes in map form showing the status of both horizontal and vertical control in the United States and its possessions have been published by the U.S. Geological Survey. These index maps indicate by color and pattern the control surveys established by the Geological Survey, the U.S. Coast and Geodetic Survey, and other federal agencies. Copies may be obtained without charge from the Map Information Service, U.S. Geological Survey, Washington 25, D.C.

Modular Coordination. Application of the principles of modular coordination need not wait until all building products are available in modular sizes, according to an article, "Coordination and Standard Products in Small House Design," published as Technical Bulletin No. 9 of the Housing and Home Finance Agency. The article also contends that the modular coordination approach to cost savings does not necessarily result in standardized houses and does not restrict freedom in design. Inquiries should be addressed to the HHFA, Office of the Administrator, Washington 25, D.C.

Brick Construction. *Bricklaying,* publication of the New York State Vocational and Practical Arts Association in cooperation with the Structural Clay Products Institute, recognizes the need for coordinating trade skills with related technical information. Subjects covered include masonry materials; tools, equipment and safety; trade mathematics and estimating; trade drawing and details of construction; and shop practice, including suggested job projects. Copies may be obtained from Delmar Publishers, Orange Street and Broadway, Albany 7, N.Y., at $2.75 in plastic-bound paper covers, and $3.75 in de luxe cloth binding.

Inland Waterways. Comprehensive data on large rivers of the United States are given in Survey Circular 44 recently issued by the U.S. Geological Survey. Copies are free on application to the Director of the Geological Survey, Washington 25, D.C.

Hydraulic Engineering. General problems of unsteady flow in open channels are treated in a recent publication of the Rocky Mountain Hydraulic Laboratory, entitled *Graphical Integration of Partial Differential Equations.* A translation of an analysis of the seeming vagaries of surges and flood waves by the Belgian hydraulician and mathematician, Junius Massau, this work incorporates much original material. The present translation, by Henri J. Putnam, professor emeritus, Universite Laval, Quebec, is available from the Rocky Mountain Hydraulic Laboratory, Allenspark, Colo., at $2 per copy.

Housing, Bibliography. Literature on housing and related fields is listed in a revised compilation of the Housing and Home Finance Agency, entitled *Reading List on Housing in the United States.* The list includes publications of the HHFA and its constituent agencies; a topical listing of government and privately published works; a listing of the principal periodicals frequently publishing articles on housing and related subjects; and a chronological listing of recent legislative documents of major interest in the housing field. Inquiries should be addressed to the Office of the Administrator, HHFA, 1626 K Street, N.W., Washington 25, D.C.

Port Development. Publication of revised reports on the Port of Wilmington, Del., and on Delaware River ports above and below Philadelphia has been announced by the U.S. Maritime Commission. Issued as Nos. 8 and 9 in the Port Series, the reports sell for $1 and $1.25, respectively. Copies may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D.C.

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Surveys. Three recent Department of Commerce publications cover a wide range of information on surveying and mapping. These are Special Publications No. 239, "Manual of Geodetic Leveling" (price about 50 cents), and "Manual of Leveling Computation and Adjustment" (price 75 cents), both by Howard S. Rappleye, M. ASCE. The third is Special Publication No. 242, "Definitions of Terms Used in Geodetic and Other Surveys" (price 45 cents), by Hugh C. Mitchell. All may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D.C.

Structures. A wide range of information on composite beam structures is presented in the second edition of *Alpha Composite Construction Engineering Handbook*. The 115-page mimeographed publication includes trial design tables based on the usual value of $n = 10$ for both rolled beam and welded composite sections; recommendations for designing and detailing spiral shear connectors with suggested specifications; and data on composite construction of continuous spans. Copies may be obtained without charge from the Porete Manufacturing Co., North Arlington, N.J.

Traffic Control. Numerous phases of the traffic problem are discussed in Bulletin No. 15 of the Highway Research Board, which consists of a report of the Board's Committee on Parking and three papers presented at its 27th annual meeting, in Washington, D.C., in December 1948. Address inquiries to the Highway Research Board, 2101 Constitution Ave., Washington 25, D.C.

Industrial Hydraulics. Proceedings of the Fourth National Conference on Industrial Hydraulics, held in Chicago in October 1948, are now available in printed form. Copies of the 154-page volume, containing 120 illustrations and twelve major papers, sell for $3, upon application to Sidney F. Musselman, conference secretary, Illinois Institute of Technology Center, Chicago 16, Ill. The conference was sponsored by Armour Research Foundation of Illinois Institute of Technology and the Graduate School of the Institute, in cooperation with local sections of the Founder Societies and other technical groups.

Groundwater Studies. A report describing the groundwater resources of Allegheny County, Pennsylvania (including the city of Pittsburgh), which will assist industries, municipalities, and engineers in locating well-water supplies and permit more complete utilization of underground water, has been prepared by the U.S. Geological Survey and the Pennsylvania Topographic and Geologic Survey. Pending publication of the report by the latter agency as a supplement to its Bulletin W-1, typewritten copies may be examined at the Geological Survey, Washington; the Philadelphia Academy of Natural Sciences; the New Federal Building in Pittsburgh; and at the Pennsylvania Topographic and Geologic Survey, Harrisburg, Pa.

Technical Cooperation. Government activities in the field of scientific, educational, and cultural exchange with the other American republics, conducted during the past year, are reviewed in a recent release of the Office of Public Affairs of the Department of State, entitled *Technical and Scientific Cooperation*. Inquiries should be addressed to the Superintendent of Documents, Government Printing Office, Washington 25, D.C.

Construction Costs. Cost-saving methods and techniques in house construction are covered in Bulletin No. 8 of the Housing and Home Finance Agency, which is being issued in connection with the Economy Housing Program. Economies detailed in the 245-page bulletin include possible omission of basements; use of preassembled wood roof trusses; attention to insulation, crawl spaces, and fuel consumption; planning before designing; modular coordination; design and site orientation; and use of power tools and equipment. Reprints of the individual articles comprising the bulletin may be obtained from the HHFA, Office of the Administrator, Washington 25, D.C.

Water Meters. For the first time since the war reprints of the pamphlet, "Water Metering and Water Estimating," are available. Written for laymen, the pamphlet is designed to help municipal and private water works operators explain water meter costs and functioning to their customers. Copies are available for quantity distribution at nominal prices by the publisher, the Ambassador Co., Temple, Tex.

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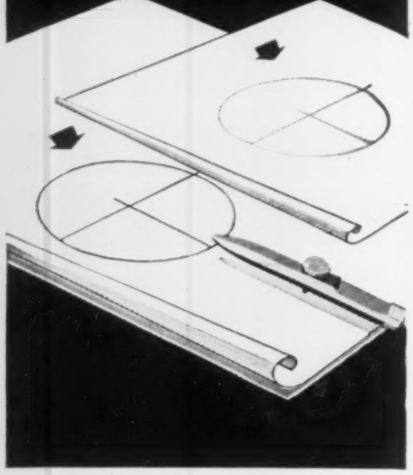

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Recent BOOKS

ADVANCED SURVEYING AND MAPPING. By G. D. Whitmore. International Textbook Company, Scranton, Pa., 1949. 619 pp., illus., diagrs., charts, tables, 8×5 in., paper, $5. This book provides instruction material for a college course covering such subjects as geodetic surveying and mapping, precise surveying in city work, and aerial photogrammetry. Complete detailed descriptions are given for methods of making field measurements and observations and procedures for performing calculations. A working knowledge of elementary algebra and plane trigonometry is assumed. A brief treatment of the practical application of the theory of least squares is appended.

COMPUTATION CURVES FOR COMPRESSIBLE FLUID PROBLEMS. By C. L. Dailey and F. C. Wood. John Wiley & Sons, New York; Chapman & Hall, London, 1949. 33 pp., text, charts, 11¼×9¼ in., paper, $2. Serving as supplementary material to the text, "Aerodynamics of a Compressible Fluid," by Liepmann and Puckett, this volume presents a series of charts in three sections: Energy relations and heat addition functions, plane shock and expansion relations, and conical flow relations—Taylor-Maccoll theory. A brief discussion is given of each function and its corresponding plot to explain its use.

ENGINEERING LAMINATES. Edited by A. G.-H. Dietz. John Wiley & Sons, New York; Chapman & Hall, London, 1949. 797 pp., illus., diagrs., charts, tables, 9¼×6 in., cloth, $10. Written by 24 experts, this book is of interest to those concerned with the design, manufacture, and use of structural materials. It explains the mechanics of laminate materials from basic properties, through physical and chemical properties, to industrial uses. Among the wide range of types and topics discussed are plywood, sandwich-type building panels, clad metals, glass-lined steel, sprayed coatings, and laminating adhesives. Decorative laminates are not considered. Extensive chapter bibliographies are provided.

FIVE-FIGURE TABLES OF MATHEMATICAL FUNCTIONS, 2 ed. By J. B. Dale. Edward Arnold & Co., London; Longmans, Green and Co., New York, 1949. 121 pp., tables, 8¾×5½ in., cloth, $1.50. This small book provides tables of logarithms, powers of numbers, trigonometric, elliptic and other transcendental functions. Decimal equivalents, conversion of time and angular measure, and a compilation of special numbers used in calculations are included. The five-figure entry has been used as the most effective for all-around practical purposes.

✓ INTERNATIONAL COMMISSION ON LARGE DAMS (Commission Internationale des Grands Barrages), 3rd Congress, Stockholm, 1948. Unbound numbers. Permanent Secretary, Commission Internationale des Grands Barrages, Bureau Permanent, 3 Rue de Messino, Paris VIII, France. Bound volumes may be ordered from Gail A. Hathaway, chairman, United States Committee on Large Dams, special assistant to Chief of Engineers, Office of Chief of Engineers, U.S. Army, Washington, D.C., paper, 9×6 in., apply. A wide range of topics is covered by this set of papers, presented at the Third Congress on Large Dams. The papers are grouped under broadly classified general subject headings designated as Question No. 1, No. 2, etc., and are customarily in either French or English, with summaries in both languages. As the expression of authorities in the field on recent developments and current practice, these international conference papers are of essential importance.

TABLES OF BESSEL FUNCTIONS OF FRACTIONAL ORDER, Volume 2, prepared by the Computation Laboratory of the National Applied Mathematics Laboratories, National Bureau of Standards. Columbia University Press, New York, 1949. 365 pp., tables, 10¾×8 in., cloth, $10. The present volume, devoted to the tabulation of $I_\nu(x)$ for $I_\nu = 1/4, 1/2, 2/3, 3/4$, is a sequel to the volume containing $J_\nu(x)$ for the same orders. The functional values in both volumes are given either to ten decimal places or to ten significant figures. The tables cover a range of x from 0 to 25. Tables for facilitating interpolation and a list of constants are included.

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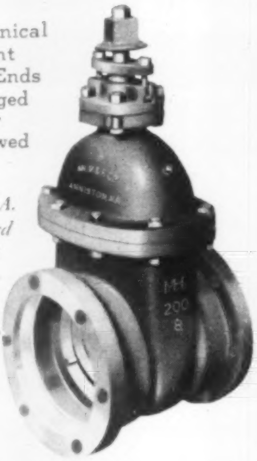
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M&H VALVE
AND FITTINGS COMPANY
ANISTON, ALABAMA

Colorado-Big Thompson Project Irrigates 600,000 Acres

(*Continued from page 30*)

The Granby Pumping Plant will be operated during offpeak periods throughout the irrigation season. However, pumping during the fall and winter months will permit the diversion of the western slope waters to conform closely to the monthly energy requirements. During the months when irrigation requirements are at a minimum, the water will be stored in the foothills reservoirs.

The highly complex operation plan requires the close control of water flow at the inlet to the Adams Tunnel, Estes Power Plant, and the outlet of Estes Lake. The flow through the tunnel will be uniform and the power generation at Marys Lake Plant likewise will be uniform. The pondage in Marys Lake, together with the regulation storage capacity in Estes Lake, will permit the Estes Power Plant to provide peak-load generating capacity for the interconnected power system. Releases from Estes Lake are to be uniform also, although some slight variation will probably be necessary to achieve maximum utilization from the eastern-slope power plants.

A central dispatching headquarters for the power system is now tentatively planned near Loveland, Colo.

A total of 280 miles of transmission lines has been completed for the project. These lines include a 69-kv, 51.5-mile-long line connecting Green Mountain Power Plant with the Granby Pumping Plant and the west portal of the Adams Tunnel; a 44-kv line, 7.5 miles in length; a 115-kv line, 16 miles long; and a 44-kv, 6-mile-long line from Loveland, Colo., to the east portal of the Adams Tunnel.

Bid calls have been issued recently for the construction of the Estes Park–Marys Lake and Estes Park–Granby Pumping Plant transmission lines, the latter providing alternate specifications for either 40.5 miles of 115-kv transmission line crossing the Continental Divide, or 19 miles of 69- and 115-kv lines, including 13 miles of 69-kv submarine cable extending through the Adams Tunnel. These proposed lines are included in the total additional 720 miles of new high-tension lines which are planned to interconnect the various power facilities of the project and which are to furnish electric power to customers in northeastern Colorado.

The transmission lines of the Colorado–Big Thompson Project will be interconnected with the power systems of the Kendrick, North Platte, Riverton, Shoshone, and Boysen Projects in Wyoming and western Nebraska.

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EQUIPMENT, MATERIALS *and Methods*

NEW DEVELOPMENTS OF INTEREST, AS REPORTED BY MANUFACTURERS

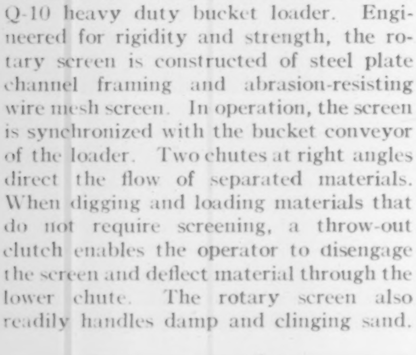
Battery Revivifier

A compound has recently been developed for the rejuvenation of electric storage batteries that fail due to neglect and old age. Reports from the use in the field of this product, AD-X2, indicate that batteries formerly considered dead and ready for scrap have been revived to normal use, with marked reduction in the amount of "shedding" of active material that was a weakness of previous battery additives. Development of AD-X2 appears to answer previous objections to use of additive salts. Tests show that after a few cycles where it has been used, the active material is found to be soft and in firm contact with the grid. So far as has been observed it remains tight to the grid during the entire remaining life of the battery. **Pioneers, Inc., 2411 Grove St., Oakland 12, Calif.**

◆

Rotary Screen Loader

Featuring one-man operation, an automatic rotary screen loader that separates sand and gravel as it digs and loads into trucks, has been introduced. The unit consists of a Nelson rotary screen mounted on a self-powered Nelson Model Q-10 heavy duty bucket loader. Engineered for rigidity and strength, the rotary screen is constructed of steel plate channel framing and abrasion-resisting wire mesh screen. In operation, the screen is synchronized with the bucket conveyor of the loader. Two chutes at right angles direct the flow of separated materials. When digging and loading materials that do not require screening, a throw-out clutch enables the operator to disengage the screen and deflect material through the lower chute. The rotary screen also readily handles damp and clinging sand. Screening capacity of dry mixtures ranges from 1 to 2 cu yd a min, depending on the size of the screen openings and the mixture of the material. Size of the screen is 3′ 4″ diameter and 4′ 10″ length. Standard screen opening sizes are $^1/_2$, $^3/_4$ and 1″ square with special size openings and construction on application. Entirely self-contained, the complete, highly mobile unit of screen, digger, loader and power plant can be moved quickly, positioned easily and put into operation without delay. **Nelson Iron Works, Clifton, N.J.**



Automatic Screen Loader

Pipe Saw

A new air-powered pipe saw that cuts cast iron or steel pipe from 12″ to 48″ in diameter at the rate of 2″ per min has been manufactured. The machine uses a high-speed steel milling cutter which leaves clean cut milled edges and requires only 85 lb of air pressure for operation. Changes in adjustment for different pipes sizes are simply and easily made by merely setting guide rollers and altering the two travel-chain lengths. The Wachs national pipe saw is strapped tight to the pipe by two silent type chains that act as a flexible ring gear for positive feed and automatically compensate for pipe "swells and irregularities." As it cuts, it travels around the pipe making the cut in one complete rotation. The saw is portable, weighing 265 lb, and can be handled and set up by two men in about 15 min. Cuts above ground are made by rolling the pipe on skids while under ground cuts require only 14″ clearance in the ditch. Sealed construction permits cuts to be made under water where ditches are flooded. Ideal for cutting gas and petroleum product pipe lines where flames would be a hazard and also for a precision cut so necessary on large water mains. **The E. H. Wachs Co., 1525 N. Dayton St., Chicago 22, Ill.**

Air-Powered Saw in Operation

◆

Pull-Out Pumps

"Pull-Out" pumps are so designed that all working parts are removable without breaking discharge connections. Suction bell, impeller, impeller housing, shaft, motor base and motor can be removed without disturbing the column and discharge elbow. This type of unit is especially recommended for power plant condenser circulation operations where it is desirable to disengage all working parts for periodic inspection without breaking pipe or mounting connections. **Economy Pumps, Inc., Hamilton, Ohio.**

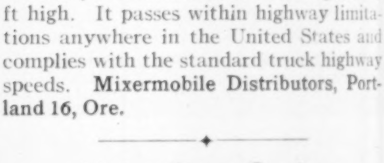
One-Yard Mixermobile

Introduction of the one-yd mixermobile, Model M-6, has been announced. Streamlined for performance, Model M-6, like its big predecessor, is a complete mobile concrete mixing and elevating plant. The machine has a hydraulically operated self-loading skip for receiving batched aggregates directly from dump trucks, portable batching plants, or front-end loaders. Although designed for one cu yd batches, the mixing drum allows for overage. The unit has a standard 35 ft steel tower, with 10 foot extensions available. From the mixing drum, the mixture is transferred by a dumping "spoon" into the elevating bucket, then hoisted and poured into the storage hopper. The model has several important features, including the hydraulic operation of the skip and a single suspension drum mounting. The drum is driven by enclosed gears. When the drum is revolving, the mixture can be visually inspected through either front or rear openings of the drum. The water system of the M-6 has been termed "foolproof." The water meter can be checked and locked, so as to prevent any variance in quantity of water. Folded for traveling, the one-yd mixermobile is 24 ft long and 12 ft high. It passes within highway limitations anywhere in the United States and complies with the standard truck highway speeds. **Mixermobile Distributors, Portland 16, Ore.**

◆

Heavy Duty Grader

To help road builders and earth movers do heavy work at less cost, the WARCO 4D-100 extra heavy duty motor grader has been manufactured. This motor grader is the first built by Riddell in the 100 hp class. The machine has been thoroughly tested under demanding conditions by a leading state highway commission, the company reported. Ditching, back filling, bank sloping, scarifying, applying black top, and fine grading were typical assignments. Outstanding "on the job" advantages claimed for the new WARCO include: full 360° revolving of the circle without removing the scarifier or teeth; less operator fatigue because of easy hydraulic control; unusual blade reach; and exceptional clearances under the front axle and transmission. **W. A. Riddell Corp., Bucyrus, Ohio.**

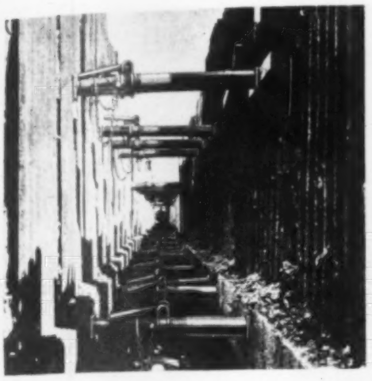


Grader Model 4D-100
For Extra-Heavy Duty

Equipment, Materials & Methods (Continued)

Steel Trench Jack

SEVERAL NEW CONSTRUCTION devices designed to reduce material and labor costs have been introduced, and have attracted considerable interest among construction men and those associated with the building industry throughout the United States. Of particular interest is the Acrow adjustable steel trench jack, designed primarily for lateral strutting in trench excavations.



Section of Trench Excavation Showing Lateral Strutting

The adjustment feature of the jack, which is a screwing action, consists of a nut located over a square-cut thread, cut four threads to the inch, which activates a pin passed through the slot in the outer section, and through closely spaced holes in the inner section. The jack is manufactured in three sizes which cover a range of adjustment from 1′6″ to 5′6″ and of prime importance is the safety feature which incorporates end plates especially designed to insure positive and safe fixture in trench walings. The jacks are placed in position by one man and have no loose parts. Also, they are of such rugged construction as to insure especially long life. Other Acrow products include road forms, scaffold stands, forms and column clamps—all in steel. Fully descriptive catalogs are available by writing to **Acrow, Inc., 420 Lexington Ave., New York 17, N.Y.**

◆

Concrete Vibrating Screed

A GASOLINE-POWERED vibrating screed has been developed and is now in production. The screed, which is almost self-propelling, handles large slabs, roadways, floors, airport runways, aprons and many other concrete jobs. With this screed, two operators can strike-off a slab 12 ft wide and 10 in. thick—even in the stiffest concrete. It leaves the surface of the slab so true to grade that it is practically finished. It also eliminates hand-puddling and spacing, saving considerable cost, both in material and labor. The complete unit includes a sturdy 1½ hp power-pak, with built-in vibrator, mounted on heavy brackets, which are bolted to the beam. The engine base plate is mounted on four

(Continued on page 98)

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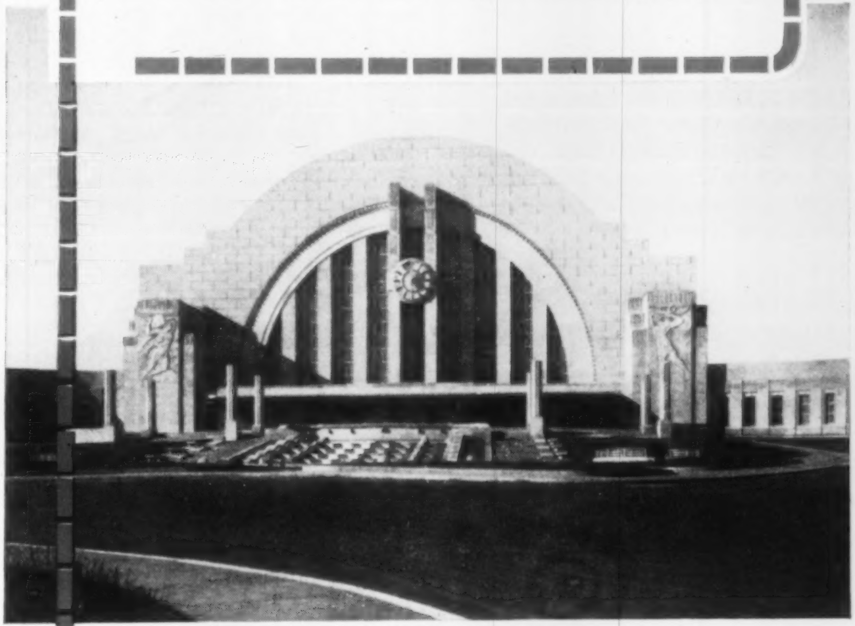

Passenger Station of the Cincinnati Union Terminal, Cincinnati, Ohio.

CINCINNATI'S Union Terminal was completed in 1933 at a cost of $41,000,000. This tremendous railroad terminal was constructed on a filled site; therefore, it was necessary to found almost all of the structures on piling. Nearly 10,000 creosoted pine piles, ranging from 45′ to 65′ in length, were used. Today, each of the creosoted foundation piles is *still* carrying 30 to 35 tons . . . *without settlement in the heavy fill.*

During the construction of this project, because the heads of all timber piles were so far above ground-water level, engineers of the Terminal Company made an exhaustive study of the permanence of creosoted wood piles. Their conclusion: pressure-creosoted wood, when embedded in earth, regardless of the moisture in the soil, *may be considered as permanent construction.*

Also, competent authorities have estimated that the use of creosoted timber piles undoubtedly accounted for a saving of close to $500,000 over any other type of permanent piles which could have been used in this construction.

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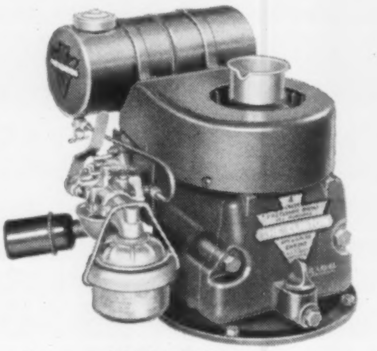
Equipment, Materials & Methods (Continued)

multiplane vibration dampeners to absorb screed vibration in both the vertical and horizontal planes. This unique engine mount makes possible long, continued usage without excessive wear. In a test, a power-pak withstood 200 hr of continuous operation at more than 5,000 vpm without damage. **Stow Mfg. Co., Binghamton, N.Y.**

◆

Vertical Shaft Engine

A VERTICAL SHAFT type engine, known as VS-700, has been designed and developed in answer to a specific demand for such an engine by manufacturers of rotary-blade type lawn mowers, jet pumps and other products which need the same type motor. The VS-700's weigh approximately 35 lb, develop $1\frac{1}{2}$ to $1\frac{3}{4}$ hp, are 4-cycle, extra heavy duty, full carburetor equipped, and are available with or without mounting flange. The machine has needle bearings as main bearings, extra heavy spring-loaded oil seals, and an adjustable air-velocity governor. Ignition is dustproof, waterproof and with high-voltage output for extremely quick starting and smooth running at low speeds. Clinton's splash-type lubrication features an excellent oil distributing system with oil level below moving parts. Superior scavenging of exhaust gases produce greater efficiency, and tests prove superior ramming of intake fuel mixture into combustion chamber. Bearing area is approximately 30% greater than similar engines, providing longer life and greater usage of horsepower. **Clinton Machine Co., Clinton, Mich.**



Model VS-700

◆

Drafting Instrument

A NEW DRAFTSMAN'S INSTRUMENT which makes it comparatively simple to create perspective drawings has just been announced. The Bruning Perspect-O-Metric automatically guides the draftsman's pencil toward the established vanishing points from any position upon the drawing board. Special scales instantly reduce distant portions of the subject to their correct proportions. It attaches to

(*Continued on page 99*)

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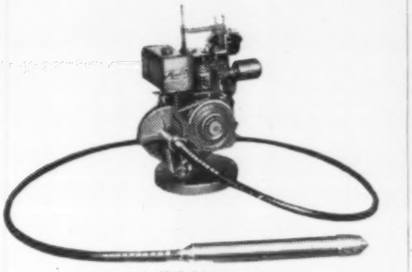
Equipment, Materials & Methods (Continued)

any standard drafting machine and has three scale arms. The central arm is fixed in a position at right angles to the established base line. The left and right scale arms pivot at one end and swing in the plane of the drawing board. The instrument provides for two vanishing points. To prevent the scales from shifting under the pressure of the draftsman's pencil, a left and a right brake lever are provided. The Perspect-O-Metric may be used for isometric drawings. Further information may be obtained by writing for Bulletin A-1045. **Charles Bruning Co., Inc., 4754 Montrose Ave., Chicago 41, Ill.**

◆

Gas Engine Vibrators

The horsepower of gasoline engine models and electric and pneumatic concrete vibrators, has been increased by the manufacturer, Mall Tool Company. All $1^1/_2$ hp units have been increased to 2 hp; all 3 hp models to 4 hp. This news will be welcomed by contractors with construction jobs in areas several thousand feet above sea level, as the added horsepower will compensate for any loss in power occasioned by the thinner air in the higher altitudes. **Mall Tool Co., 7795 S. Chicago Ave., Chicago 19, Ill.**


Mall Vibrator

◆

Portable Hoist

The "Lug-All," a portable hoist weighing only $8^1/_2$ lb, yet capable of lifting $1^1/_2$ tons has recently been manufactured. The hoist may be used by a single worker, thus saving the time of the extra man who normally helps to carry and lift older type, heavier hoists of the same rated capacity. Designed with a minimum of parts, it is claimed the Lug-All can be repaired right on the job with just a wrench and/or a screw driver, thus eliminating the need for returning the hoist to the factory for repairs. The handle may be reversed so that the user may take advantage of easier operating conditions in tight places. Instead of a chain which often kinks, Lug-All construction employs a 133 strand aircraft cable which reels out easily without snagging. Limit for the cable is 15 ft, at which length the hoist capacity is 1,500 lb. **Lincoln Precision Machining Co., North Grafton, Mass.**

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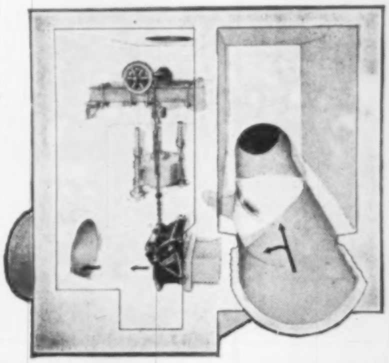
Fig. B-19

Automatic Sewage Regulators control sewage flows either by partially or completely cutting off such flows to suit head or tail water conditions or by "governing" to discharge a predetermined quantity regardless of head or tail water conditions.

Descriptive Bulletins and Engineering Data Available Upon Request.

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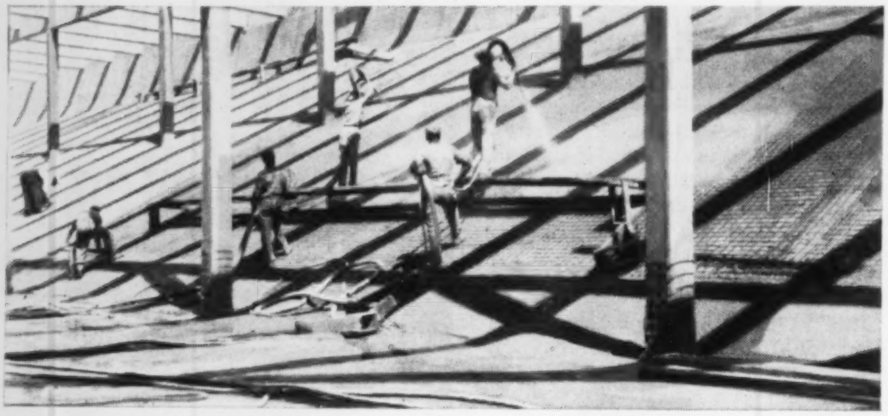

When the old, open Ballou Park Reservoir at Danville, Va., was improved and covered in 1948, excessive leakage of the old brick lining was stopped with reinforced "GUNITE". The photo shows details of the process. After concrete columns to support the roof were placed, wire mesh reinforcing was laid and the entire reservoir was "GUNITED". Note that the reinforcing and "GUNITE" were carried over the column footings and up the columns approximately three feet to prevent leaking at those points.

The use of "GUNITE" for repair and construction of reservoirs, bridges, buildings, etc., is illustrated and described in Bulletin B2400. We will gladly send a copy at your request. On your letterhead, please.

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Equipment, Materials & Methods (Continued)

Submergible Sump Pump

A COMPLETELY SUBMERGIBLE sump pump, capable of continuous, uninterrupted operation is announced. The manufacturer states that the P-109 is the first pump designed to pump a sump dry to eliminate stagnant, dirty water. The turn-on point, or height of water which is required to start the pump, is easily adjustable from a few inches to several feet without special tools. The diaphragm switch has no moving parts exposed to water, and is said to be the only sump pump switch that does not require a float. Pressure of rising water actuates the switch which is located in the discharge line, and subsequent pumping action keeps it in operation. The switch automatically shuts off when the pump draws air. It weighs 45 lb and is only $9^1/_2$ in. high and 11 in. in diameter. Because of its compact size, low weight, and total submergibility, many plumbers and contractors find it a handy, portable unit to carry in their service cars for special drainage jobs, and emergencies. The unit can be quickly positioned for use wherever current is available. **Kenco, Inc., Elyria, Ohio.**

Portable Pumping Unit

◆

Jackhamer

A MEDIUM-WEIGHT JACKHAMER, known as J-40, has been introduced. Capable of drilling in any kind of rock, it is particularly well suited for general utility service in mines, quarries, and road work. Powerful blows, strong rotation of drill steel, and plenty of hole-cleaning ability result in faster drilling speeds for the J-40. A double-kicker port valve permits full air pressure on the piston for a longer period of time, giving more powerful blows and much stronger rotation. The design of the throttle valve and the air-supply port permits the gradual admittance of air into the cylinder, making the collaring of holes easier. A three-in-one backhead enables the machine to be quickly adjusted for wet, dry, or blower-type drilling. The J-40 jackhamer was designed with carset (set with tungsten carbide inserts) jackbits in mind and is especially suited for use with these new bits. **Ingersoll-Rand Co., 11 Broadway, New York 4, N.Y.**

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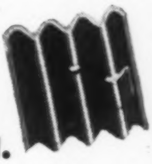
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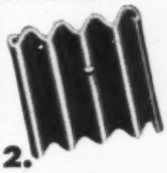
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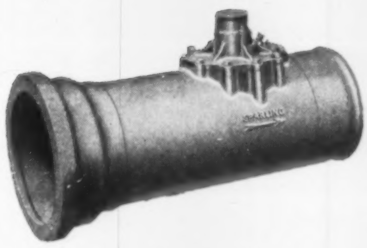

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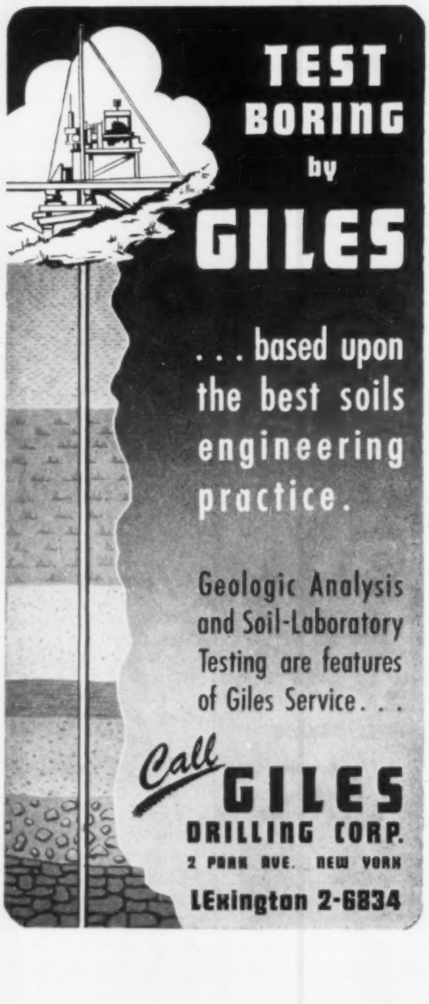

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Literature Available

WIRE ROPE—A new folder has just been released containing questions and answers on preformed wire rope, stating questions normally asked about this product and giving the answers. Copies are available by writing to **Macwhyte Co., Kenosha, Wis.**

STEEL STREET FORMS—A 28-page booklet, Bulletin No. 2259, gives detailed information on steel street forms. Altogether, 16 types of forms, embodying a completely standardized and inter-related steel form system, are described and illustrated. A pictured guide also shows how to set and strip the forms in actual use. **Blaw-Knox Div., Blaw-Knox Co., P. O. Box No. 2, Blawnox, Pa.**

LIGHTWEIGHT AGGREGATE—A 4-page folder offers reference information on Solite, a new lightweight aggregate. The booklet describes the strength, refractory and insulating qualities, chemical inertness, unit weights and durability and soundness. Test data charts and diagrams are also included. **Southern Lightweight Aggregate Corp., P. O. Box 1-J, Richmond 1, Va.**

ZEOLITE WATER SOFTENERS AND ION EXCHANGERS—Bulletin No. 2386 describes the troubles caused by hard water, outlines the properties of ion exchangers, explains and illustrates the most up-to-date ion exchange equipment. A description of the new manually or automatically controlled multiport valves is also given. **The Permutit Co., 330 W. 42 St., New York 18, N.Y.**

CENTRIFUGAL PUMPS—A new line of pumps, designated as Type A, is comprehensively described and illustrated in Bulletin No. B-1300, which is complete with schematic sectional drawings, application photographs and sectional and dimensional drawings and tabulated material on all sizes in the line. Copies may be obtained by writing **Peerless Pump Div., Ford Machinery & Chemical Corp., Los Angeles 31, Calif.**

VIBRATING SCREEN—A 16-page booklet profusely illustrated and containing detailed information on vibrating screens is offered. Dimension drawings for single and double deck screens, as well as diagrams are included. Other Lippmann engineered equipment such as, the portable belt conveyor, bucket type elevator, roll crusher, apron feeder and pulverizer are bound together to form a worthwhile booklet. **Lippmann Engineering Works, 4603 W. Mitchell St., Milwaukee 14, Wis.**

CONCRETE FORMING SYSTEM—"Uni-Forms, the Concrete Forming System" is the title of a 34-page booklet which is attracting the attention of more and more engineers, architects and contractors every day, because it effectively answers the construction industry's need for better, lower cost building. The booklet contains data as well as pictures which describe the economical, faster erection, easier stripping of concrete forms. **Universal Form Clamp Co., Chicago 51, Ill.**

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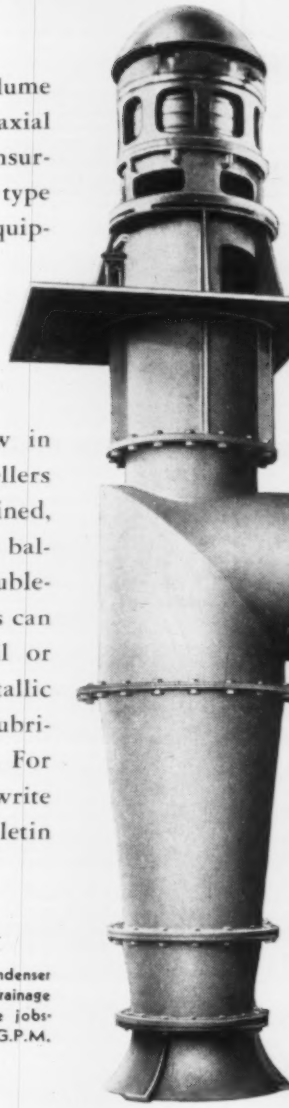

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Literature Available (Continued)

Self-Propelled Cranes—A 16-page bulletin which illustrates 48 of the various applications of self-propelled cranes for industrial material handling and construction operations has been released. The bulletin illustrates many fields in which self-propelled machines are now serving. **The Thew Shovel Co., Lorain, Ohio.**

Corrosion Resisting Steel—A 54-page booklet entitled "Mayari*R" describes thoroughly a new low-alloy steel for applications requiring light weight, high strength and increased corrosion resistance. The booklet contains many illustrations, comparison charts with other steels and diagrams. Mayari*R is ideal for buses, subway cars, trucks and trailers; marine applications; mining; industry; construction equipment and has many other miscellaneous applications. **Bethlehem Steel Co., Bethlehem, Pa.**

Hydraulic Equipment—An 8-page booklet entitled "Valves and Gates for Hydraulic Equipment," contains information which will be of value to builders and operators of hydraulic projects. It also contains data on the following classifications of large equipment—butterfly valves, slide and sluice gates, cylinder gates, hollow jet free discharge valves, and other supplementary equipment for the control and handling of hydraulic projects. Descriptive information and operational data are included for each type of equipment as well as numerous photographs, diagrams, sketches, and curves. **Westinghouse Electric Corp., Box 868, Pittsburgh 30, Pa.**

Design and Fabrication Data—To help the engineer, architect and contractor prevent roof failures caused by unusual climatic conditions or atmospheric concentrations of smoke, fumes and other corrosives, a new publication has been issued. The bulletin, "Basic Application Data," lists suggested gages for principal exterior building applications of the soft-temper monel roofing sheet introduced last year. The folder contains data on the availability and relative cost of monel roofing sheet, fabricating and installation tips and a specification wording for architects and engineers to use when specifying monel. **The International Nickel Co., Inc., 67 Wall St., New York 5, N.Y.**

Aluminum Alloy Castings—A 64-page booklet titled, "Aluminum Alloy Castings", covering the production and application of aluminum alloy sand and permanent-mold castings has been issued. The booklet reflects the many wartime advances in the aluminum casting art. Following a historical introduction, the various commercial casting alloys and their characteristics are presented. Methods of heat treating the castings to increase mechanical strength and to obtain other special characteristics are covered in a separate section, as are trimming and cleaning, and machining and finishing processes. May be obtained at the price of $.50, (no stamps). **The Aluminum Assoc. 420 Lexington Ave., New York 17, N.Y.**

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